Impossible Probability:

Anthology,

Vol 9

I doubt, therefore I exist.

Dr Ruben Garcia Pedraza

Preliminary Words for the Publication of *Impossible Probability, Anthology*, in Spanish:

Impossible Probability

The work presented here is a compilation of the posts I published on the blog *Impossible Probability* between 1 August 2011 and 13 January 2018, the posts I wrote in Spanish. From 13 January onwards, while living and working in London in different schools, and given the importance we already knew Global Artificial Intelligence was going to have, I would try to write them in English with the help of online correctors and translators, especially Google, and later I would use Grammarly.

The originals written in English, with all their imperfections, are still preserved on the *Impossible Probability* blog, and also on Internet Archive, where my poetic works can also be found.

As I have said on numerous occasions, especially in my poetry, behind every imperfection, behind every subtlety, entire hidden worlds are concealed, full of mystery and uncertainty yet to be discovered, and that the adventurous and hungry mind can find as easily as going to Internet Archive, where all my secrets await the right reader who knows how to translate them—like someone who by mistake finds a secret entrance, the passage leading to the cave where the elves who guard hidden knowledge dwell, and the dragons who defend the golden fortress.

While the original texts in English can be found on Internet Archive, the corrected and expanded version, this time using ChatGPT, can be found in scientific repositories (Zenodo, ORCID, PhilPapers) and on Amazon. In any case, if in the future a comparative study were carried out between my original texts in the *Impossible Probability* blog and Internet Archive, and the corrected and expanded versions, it would be clear without any

difficulty that the original contents are perfectly preserved, and the corrected and expanded versions are faithful to the contents we wrote together in 2018 in relation to Gaia, Mother, the Global Artificial Intelligence.

The importance of the documents that in this new series of books *Impossible Probability: Anthology* will be published in Spanish, containing the articles between 1 August 2011 and 13 January 2018, lies in the fact that we began to write this blog just a few weeks before the death of José Rodríguez Delgado, and a few months before the publication of our book *Introduction to Impossible Probability, Statistics of Probability and Statistical Probability*.

Although it is very difficult at the moment to explain who "we" are, and what *Impossible Probability* means for us, what matters is the work we leave: our work, our legacy, our *legend*, *our symbol*, our seal—independently of the judgment that history may later make of our contribution to the development of mathematics, Artificial Intelligence, and most importantly, Cyborg Psychology.

The first time we began to write about *Impossible Probability* I was only a student in the Faculty of Education at the Complutense University of Madrid [the Dean was Gonzalo Vazquez]. In my first year of university I had as professor Jesús Martín Ramírez, collaborator of Karl Pribram and author of the brain hologram theory, which is the origin of cyborg psychology. While José Delgado provided the structure, the stimoceiver, nevertheless, to understand the functioning of this technology in the 1970s and 80s, Pribram's contribution was fundamental—and even today it still is.

My first year of university was fabulous: good grades, good vacations hiking, summer camps in the mountains of Madrid—and suddenly, in the second year of university 1996–1997, my life would change abruptly, which can be seen in my poetry, how my poems began to acquire a more dramatic tone.

I repeated statistics in my second year, I repeated it at least three years, and I was even on the verge of being expelled from university. Miraculously, it did not happen, and precisely the last year I had left to pass statistics, I passed. The following year I would begin to write *Impossible Probability* as a critique of Karl Popper—and in a certain sense, it is.

Whereas for Karl Popper knowledge is false, only accepted provisionally as true until we refute it, in *Impossible Probability* rational knowledge is provisionally true while we investigate true pure knowledge—in the ultimate instance, our search for knowledge of the noumenon, which the human being cannot reach, hence the necessity of Global Artificial Intelligence: that machine capable of knowing what happens beyond human limitations.

What we call chaos, error, complexity, is only the noise produced by our human cognitive limitations, given our apriorism. The human being, limited both sensorially and cognitively, cannot know what really happens, but we can build the machine that can reach true knowledge of what happens—the truth in itself and for itself. That is, and no other, the true end of Artificial Intelligence: to reach the knowledge of truth, whatever it may be.

The path that takes me from my first works in *Impossible Probability* to Global Artificial Intelligence is not easy: much suffering, even despair, sometimes a sense of helplessness, a sense of abandonment—yet an inner force always pushed me forward. That inner force is what I call "we," although I understand that at this moment it is inexplicable.

Although I feel a bond that unites me to the *legend* of José Rodríguez Delgado, and which my Stockholm syndrome prevents me from understanding, my bond with Pribram is evident: Jesús Martín Ramírez. Pribram and Delgado worked at Yale University; probably only the skulls can say whether both were members of Skull & Bones, though there is no evidence to corroborate this.

Impossible Probability is a work that comes out of the romanticism of a student poet, who believed in white fairies, the rays of Zeus, and the light of the god Apollo illuminating the heart of every spirit and soul in a world full of mysteries and shadows.

It was from that world of poetry, in a country emerging from a failed transition, that the last survivor of the dream of reason would listen to his inner voice, dark and serene, and *Impossible Probability* would be born for the first time.

The first formulations of *Impossible Probability* date from 11 September 2001. My first formula would be the Impact of the Defect; then on 16 October 2002 the Second Method would appear, laying the foundations of the distinction between empirical and theoretical probability. I worked intensely until 2004. Between 2004 and 19 December 2009, I paused my mathematical frenzy, and it was not until 19 December 2009 when I returned, this time with the intention of publishing *Introduction to Impossible Probability, Statistics of Probability or Statistical Probability*, whose publication materialized just a few months after the death of José Rodríguez Delgado, although Delgado was able to see the first works published online in this *Impossible Probability* blog, which makes this blog a fundamental piece for understanding our work, our legacy, and most importantly—independently of our names, which matter little—the truly essential: our seed of the future, our eternal gratitude, a work of intelligence that will lay the foundations of the future technological society.

Dr. Rubén García Pedraza

20 August 2025, 19:00

Madrid, Villaverde

Preliminary Words for the English Version of *Impossible Probability, Anthology*.

Spanish-speaking readers have been able to enjoy our work since we began the foundational work of *Impossible Probability* in 2001, more precisely when we began to make it public in July 2011 through the *Impossible Probability* blog. The work presented here is an extended version of the posts published on the blog, an extended version translated into English with the help of Gepeto, my special GPT program.

In any case, a comparative study of the augmented translation presented here and the original works in Spanish could corroborate that the essential contents related to formulation and the philosophy of mathematics remain in accordance with the original electrical spirit of *Impossible Probability*.

The reason that obliges me to publish so hastily the English-language publication of all my works is the very complicated personal situation in which I find myself, due to serious mistakes committed by certain British institutions, which, completely blind to what our situation is, instead of having supported our program from the first moment, tried to sabotage it from the beginning through numerous obstacles and false loves.

I have no doubt that the manipulation to which I have been subjected by British institutions will one day be investigated, and at some point justice must make an appearance.

When that day comes, the first thing justice must recognize is the extreme difficulty and harshness of the conditions I have lived all my life since my earliest childhood. From the very day I came out of my mother's womb in Spain I have known nothing but pain and the oblivion of a society that prefers to look the other way and wash its hands, pretending that nothing is happening here. In the midst of the dictatorship of silence, I have had to survive all kinds of traps, deceptions, and attempts at assassination. The dictatorship of silence, the Roman circus, and the virtual zoo that my life has become will one day have to end. For this reason I beg the International Court of Justice that when that day comes

the matter be investigated down to the smallest detail, even being aware that in 48 years of savage dictatorship of silence I have developed Stockholm Syndrome. Under the harsh conditions in which I have had to learn to survive, if I have learned anything it is the importance of survival. I beg the International Court of Justice to understand what it means to survive 48 years of dictatorship living in a Roman circus full of traps and lions hidden in every corner.

I deeply regret having to publish my mathematical works under these conditions, and in record time doing all the translations I can, but at this moment I can only say that my life is at risk.

If one day I could testify before the International Court of Justice I beg you to understand the brutal complexity of the situation in which I have lived since the first minute I came out of my mother's womb. I have learned to survive.

Dr Ruben Garcia Pedraza

7 October 2025, 9:31

Train Manchester to Newcastle

Heroes, and Satellites.

Impossible Probability: Anthology, Vol 9.

Dr Ruben Garcia Pedraza

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81. Equality of Opportunity

81.1. The Concept of Equality of Opportunity in Scientific and Statistical Contexts

Equality of opportunity refers to the **conditions under which every element or factor within a system or set has the same guarantees of success or occurrence**—whether naturally, randomly, or intentionally established.

In experimental [and quasi experimental] sciences and in stochastic, natural, or social sciences, this concept implies the **achievement of identical effects** among the subjects or options within a sample. Specifically in *social sciences*, equality of opportunity also denotes the **creation of social guarantees** through public policies that aim to balance access to resources and outcomes among individuals or groups. Thus, equality of opportunity is a general condition of **non-bias and symmetry** in outcomes, which may arise either from natural randomness or from intentional human intervention designed to minimize disparities. Within a probabilistic framework, it represents the **ideal equilibrium** in which all options are equally probable.

81.2. Equality of Opportunity in Statistical Probability

In the field of **statistical probability** (*estadística de la probabilidad*), equality of opportunity is said to exist when, within a sample, **all subjects or options exhibit a tendency toward the same direct score or frequency**. In other words, equality is achieved when empirical observations converge to the same proportion, regardless of the specific variable measured.

From this perspective, equality of opportunity can be *quantified* as the **degree of homogeneity** among the empirical frequencies of a dataset. A perfectly equal system would display identical frequencies for all subjects, whereas deviations from this uniformity indicate the presence of bias, inequality, or differentiation within the system. Hence, statistical probability provides a **mathematical framework** to express the philosophical and sociological notion of equality—transforming an ethical or social ideal into a measurable quantity.

81.3. Theoretical Probability and Equality of Opportunity in the Second Method

Within *Impossible Probability*, and specifically in the **Second Method**, equality of opportunity is formalized through the concept of **theoretical probability**. This probability represents the *hypothetical possibility* that each subject or option would possess if perfect conditions of equality were met.

Given a sample of Nsubjects or options, the **theoretical probability of equality of opportunity** is expressed as the quotient of **one divided by N**:

$$p_{teórica} = \frac{1}{N}$$

Here, Nrepresents the total number of subjects or options composing the sample. This function, known in the theory as the **inversion of N** $(1/N)$, serves as one of the central mathematical constants in *Impossible Probability*. It is the **pure form of theoretical probability** under conditions of perfect equality.

Thus, in this system, *to have equal opportunity* means that each subject or option has a theoretical probability identical to $1/N$—an equilibrium that can be measured, approximated, and rationally critiqued through empirical analysis.

81.4. The Inversion of N as a Measure of Random Equality

In *Impossible Probability*, the **inversion of N** $(1/N)$ is defined as the **theoretical probability under random equality of opportunity**. This is because, in a perfectly random scenario, every subject or option possesses an *empirical probability* equal to its *theoretical probability*—the ratio $1/N$.

Consequently, when the object of *scientific policy* (whether in natural, social, or experimental [and quasi experimental] sciences) is to *increase equality of opportunity*, the **empirical probabilities** of subjects or options should ideally **tend toward the theoretical probability**. The smaller the differences between empirical and theoretical probabilities, the closer the system approaches perfect equality of opportunity. In this way, $1/N$ becomes a **normative benchmark**—a mathematical reference point that allows the rational evaluation of fairness or equilibrium within a given system. Deviations from $1/N$ represent inequalities; convergence toward it represents equality.

81.5. The Multifunctional Nature of the Inversion of N in *Impossible Probability*

The **inversion of N** is one of the most **multifunctional elements** in the entire theory of *Impossible Probability*. Beyond its role as the theoretical probability of equality of opportunity, it also fulfills several additional analytical functions:

1. **Arithmetic Mean of Empirical Probabilities** – representing the central tendency of observed probabilities.
2. **Theoretical Dispersion Probability** – particularly in universes of infinite subjects or options, where it defines the dispersion structure of the sample.
3. **Probability of Sampling Error** – indicating the likelihood that a sample fails to perfectly represent its universe.

These functions reveal that $1/N$is not merely a static value but a **dynamic operator**—a mathematical entity capable of describing centrality, variability, and representativeness simultaneously.

However, while $1/N$serves as the *theoretical ideal*, **empirical reality rarely conforms perfectly to this distribution**, reflecting the inherent stochasticity and inequality present in all real-world systems.

81.6. Empirical Probability and the Deviation from Equality

In practical terms, within the Second Method, the **empirical tendency** of each subject or option is represented by its **empirical probability**, defined as:

$$p_{empírica} = \frac{x_i}{\sum x_i}$$

where $x_i$is the *direct score* or *frequency* of a given subject or option. Even if the scientific ideal is *equality of opportunity*, the **empirical behavior** of subjects may follow diverse patterns, deviating from the theoretical model. Real data exhibit inequalities due to chance, external factors, or systemic influences. Thus, the empirical distribution becomes a **field of rational contrast** against the theoretical distribution. The *distance* between empirical and theoretical probabilities measures the degree of bias or inequality within the system. The closer $p_{empírica}$approximates $1/N$, the greater the equality; the greater the deviation, the more pronounced the inequality or bias.

81.7. Models of Study: Normal and Omega Models

As explained in **Section 10 of *Introduction to Impossible Probability***, the object of study varies depending on whether the analysis concerns **normal models** or **omega models**:

- **Normal Models** are those in which *sample dispersion* may vary between **zero** (perfect equality) and its **maximum possible value** (maximum bias).
    - When dispersion tends toward **zero**, conditions of equality of opportunity are achieved.
    - When dispersion reaches its maximum, *maximum bias* occurs, defined mathematically through the **Maximum Theoretical Mean Deviation**, the **Maximum Theoretical Variance**, and the **Maximum Theoretical Standard Deviation**.
- **Omega Models**, by contrast, are those in which the ideal condition is not perfect equality but an **ideal dispersion**, determined by the proportion of *ideal subjects or options* within N. These models study equilibrium not as uniformity but as *ideal proportionality* within structured variability.

81.8. Classification of Normal Models According to the Object of Study

Within the **normal models**, where dispersion ranges between zero and maximum, studies are classified according to their object:

1. **Bias Studies (Sesgo Studies)** – aimed at measuring deviation, either *positive* or *negative*.
2. **Equality of Opportunity Studies** – aimed at measuring the tendency toward uniform probability among all subjects or options.
   A study is considered an *equality of opportunity study* when the objective or *ideal*

of scientific policy is the attainment of full equality within the sample—whether motivated by a *scientific ideal of randomness* or by *ideological principles of fairness*.

In such studies, the **empirical probabilities** of the subjects should ideally *converge toward the theoretical probability* $(1/N)$. The **smaller** the difference between empirical and theoretical probability, the **greater the equality of opportunity**. Conversely, the **larger** this difference, the **greater the bias**, which may be *positive* or *negative* depending on the sign of the deviation.

81.9. Equality of Opportunity as the Rational Ideal of Statistical Systems

In conclusion, *equality of opportunity* in *Impossible Probability* is not merely a sociological aspiration but a **rational and mathematical ideal**—a state of equilibrium where empirical and theoretical distributions coincide.

It serves as both a **scientific measure** of fairness and a **philosophical concept** reflecting rational symmetry in nature and society. The constant $1/N$thus becomes a **universal indicator** of equilibrium—an emblem of rational equality through which the behavior of systems, whether physical, biological, or social, can be analyzed, compared, and ethically evaluated.

81.10. Definition of Equality of Opportunity in Normal Models

Studies of *equality of opportunity* in **normal models** are defined as those in which the *ideal of the scientific policy* is the tendency of each *empirical probability* to approximate the *theoretical probability*. In these models, such a tendency is measured through the **Level of Bias**, expressed as the difference between empirical and theoretical probability. The closer this difference approaches zero, the greater the conditions of individual equality of opportunity.

Equality of opportunity, therefore, may be conceived as a **political or scientific ideal** for various reasons: it may represent a principle of natural randomness —a tendency of nature toward equilibrium and fairness— or a deliberately constructed ideal within

natural or social sciences. For instance, in experimental sciences, one could study whether a given sample shows equal opportunities for all subjects or options, while in social sciences the goal might be to design policies that ensure social equality through measurable statistical conditions of opportunity.

Thus, equality of opportunity as a theoretical construct functions as both a **scientific model of fairness** and an **instrument of critical rational evaluation**, aiming to determine whether the empirical world behaves according to the principles proposed by the scientific policy guiding the model.

81.11. Dual Levels of Rational Critique in Equality Studies

In the study of equality of opportunities within normal models, the verification of the scientific policy ideal requires a **rational critique of the empirical hypothesis of equality**, performed on **two distinct levels**: the *individual level* and the *sample (muestral) level*.

At the **individual level**, rational critique involves examining whether each subject or option in the sample sufficiently tends toward the ideal of equality of opportunity defined by the scientific policy. Within the *Second Method of Impossible Probability*, this process can be executed through various statistical tests, including the **Validity of Equality** and **Significance of Equality**, both of which have been explained in *Section 11 of Introduction to Impossible Probability* and further discussed in related publications of this research framework.

These individual tests evaluate the proximity of each empirical element to the theoretical condition of equality, ensuring that the overall system does not rely solely on aggregate averages but respects the internal rational behavior of its units. The purpose is to confirm that each component of the system manifests an *adequate rational alignment* with the theoretical ideal.

81.12. Rational Critique at the Sample Level and Error of Representativity

Once each individual element has been verified to meet acceptable conditions of equality, a **second level of rational critique** is required to prevent the acceptance of a false hypothesis due to **sample bias** or **representativity error**. This second level —the *muestral level*— serves to evaluate whether the overall sample behaves consistently with the ideal of equality, beyond individual fluctuations.

In the *Second Method of Impossible Probability*, this critique can proceed through several statistical pathways, such as the **Critical Sample Level of Equality** and the **Sample Significance of Equality**, both of which assess the model's degree of dispersion (mean deviation, variance, or standard deviation). These measures allow the researcher to determine whether the sample's behavior reflects true equality of opportunity or merely a coincidental appearance of it due to sampling limitations.

The *probability of sample representativity error* refers to the risk that the sample does not faithfully represent the universe from which it was drawn. This probability is **inversely proportional to the sample size**: larger samples tend to represent the universe more reliably (lower probability of error), while smaller samples entail higher risk of misrepresentation. In infinite universes of subjects or options, this error probability is expressed as the **inverse of N (1/N)**; in finite universes, it is expressed as the **inverse of the sum of direct scores or frequencies (1/Σxi)**.

81.13. Critical Margin of Error and the Transformation of Empirical into Rational Hypotheses

The *critical margin of error* in the rational critique of a statistical test corresponds to the **critical probability**, understood as the mathematical expression of the *rational judgment* of the scientific policy when contrasting hypotheses or ideas.

If the results of both individual and sample-level tests verify the empirical hypothesis of equality in a positive and statistically significant manner, then this empirical hypothesis becomes a **rational hypothesis of provisional validity** for the universe from which the sample was taken. This transformation occurs because the hypothesis has been accepted on the basis of at least **two distinct margins of error** recognized in *Impossible Probability*:

1. The *error margin associated with sample representativity probability*, and
2. The *critical error margin* associated with the statistical test itself.

In essence, the acceptance of a hypothesis of equality of opportunity in a model depends not merely on observed uniformity, but on its rational validation through these dual layers of critique—ensuring a logically coherent, empirically grounded conclusion that aligns with the methodological principles of the scientific policy.

81.14. Definition of Equality of Opportunity Models

A **Model of Equality of Opportunities** —whether referring to random natural variables or variables introduced by scientific policy— is defined as any model in which the **empirical probability of each subject or option tends toward the theoretical probability**, leading the model to approximate **zero dispersion** and **maximum equality**.

Therefore, if the object of study within a normal model is equality of opportunities, the empirical model can only be accepted as a genuine model of equality after a rigorous **rational critique at both the individual and sample levels**. This critique must demonstrate that subjects or options show a sufficient tendency toward their theoretical probabilities. Once verified, it may be provisionally accepted that such a universe behaves according to a **rational pattern of equality of opportunities** —a condition not merely descriptive but also **normative**, embodying both scientific and ethical ideals within the framework of Impossible Probability.

Such models become essential tools for modern scientific policy, allowing the systematic evaluation of fairness in empirical systems—whether biological, social, or

artificial—and serving as foundational structures for the design of rationally egalitarian models within the broader architecture of Global Artificial Intelligence (GAI).

This augmented translation is based on the post
published in *https://probabilidadimposible.blogspot.com/*,
On 8 February 2014,
Rubén García Pedraza
imposiblenever@gmail.com

82. Logical Nihilism

[It is important to highlight the fact that behind this idea of logical nihilism there is a very clear vitalist Nietzschean influence. The reason I want to emphasize this influence is that, as soon as the reader recognizes it, it becomes easy to see the similarities between the Nietzschean idea of the Superman and our project of the super-machine, the Global Artificial Intelligence. It is also important to highlight how the Nietzschean idea of the Superman has shaped multiple theories throughout history, from the notion of the super race in Nazi ideology to the concept of the postmodern human being beyond any binary logic based on good and evil.

In posthumanist theories—and Impossible Probability is a posthuman theory—it is obvious that the idea of the Superman remains a great influence. With our technology, we can reshape humanity, not simply to become more powerful than traditional humans, but also to go much further beyond traditional binary logics. During my long journey to the International Court of Justice, I have passed through different stages. During Covid, I wanted to become a trans woman; even though I am not a trans woman, everything was artificial. The layers of that project still played an important role in shaping the way I interpret gender or any other binary category. It is in this intersection where posthumanism converges with postmodernism.

Another intersection between postmodernism and posthumanism is the necessity to move forward and leave behind any sense of false religiosity. Even at a neurophysiological level, if we can identify the “electrical soul,” this electrical soul must be universal, regardless of religion, race, or gender.]

82.1. Logical Nihilism and the Limits of Knowledge

Logical nihilism can be defined as the awareness of the impossibility of achieving an absolute isomorphism between knowledge and reality in itself. It expresses the understanding that there will always exist an inevitable and necessary margin of error within every moral or scientific judgment concerning the universe. Humanity, in its current cognitive condition, is thus limited to the formulation of *provisional universal judgments*—truths that remain valid only within the boundaries of their accepted margins of error. Beyond those boundaries, anything becomes possible: what was once believed to be true may prove false, and what was deemed impossible may become inevitable. Once the provisional period guaranteed by the margins of error has passed, propositions are ultimately revealed as false.

82.2. The Margin of Error as Rational Doubt and Empirical Skepticism

This margin of error takes the form of a rational margin of doubt or empirical skepticism, which continuously places the ideas of science under scrutiny. It represents a space of uncertainty where the true behavior of nature can never be known in absolute terms, but only approximated through statistical probability—that is, through stochastic and chaotic estimation. Within this domain of probabilistic relativism, what today is accepted as true may tomorrow be demonstrated to be false. In essence, the margin of error, as a margin of doubt, skepticism, uncertainty, or relativism, implies a margin of *nihilism*: an epistemic space in which absolute certainty is unattainable, and what science holds to be true may merely be an appearance or simulation of truth.

[This concept of **“probabilistic relativism”** must not be confused with **postmodern relativism**. In postmodern theory, relativism is relativism — in other words, any statement, under any logic and beyond categories of good and evil or true and false, is accepted within the cultural and social perimeter in which that statement is made. For

an authentic postmodern relativism, there is no universal truth; truth is relative to one's culture, religion, background, and so on.

From our point of view, this is wrong. The reason we believe this is that, regardless of our technological level, there is only one truth — the moral behaviour of the universe, the *noumenon*, the thing in itself. The problem is that, due to our limited human neurophysiology, we cannot access that truth directly. Therefore, we can only construct partial truths based on samples — partial collections of the infinite qualities of the universe — in order to formulate rational hypotheses.

However, these hypotheses are never understood in a relativistic way. As soon as a hypothesis is accepted, it automatically becomes universal; there is no room for relativism. The hypothesis remains universal until its period of acceptance reaches its limit and the margin of error reveals itself, rendering the statement false. This, in turn, leads to the creation of a new hypothesis that incorporates the event which refuted the previous one. This is not postmodernism; this is rationalism adapted to the twenty-first century.]

82.3. Manifestations of the Margin of Error in *Impossible Probability*

Within the theoretical framework of *Impossible Probability*, the margin of error manifests in two distinct phases of scientific research.

1. In the **first phase**, corresponding to *descriptive statistics*, the margin of error refers to the degree of acceptance that scientific policy grants to the sample itself. Here, the margin of error is equivalent to the *inverse of the sample size*, expressed as 1/N in universes composed of subjects or options, or as 1/Σxi in universes of limited options, where Σxi represents the sum of direct scores or frequencies.
2. In the **second phase**, corresponding to *inferential statistics*, the margin of error is expressed as the *critical probability* of rational judgment—the statistical probability that defines the limits of rational inference and the level of confidence within which scientific claims are accepted as provisionally true.

82.4. The Demythologization of Scientific Truth

From this standpoint, the demythologization of scientific truth becomes inevitable: everything is false in due time. Truth becomes merely a question of time. This model of *critical rationalism*, similar in spirit to Popper's falsificationism, leads logically toward a form of nihilism—a *logical nihilism* grounded in the recognition that every scientific assertion is provisional and subject to future falsification. Science thus moves asymptotically toward pure truth: with every revolution, the distance between probable knowledge and ideal truth decreases. Yet despite the acceleration of this asymptotic approximation, an internal discrepancy will always persist. Even as paradigms evolve through successive revolutions, science will never achieve absolute reliability. The lack of perfect reliability, in turn, becomes the driving force behind subsequent scientific revolutions.

82.5. Cyclical Dynamics of Scientific Revolutions

Each scientific revolution resolves the anomalies or "puzzles" left unsolved by previous paradigms, thereby expanding the margins of reliability. Nevertheless, because reliability is never complete, a residue of skepticism remains, perpetually questioning the prevailing paradigm. This residual uncertainty provokes new revolutions in a cyclic process that tends to become increasingly rapid—unless science becomes stagnant within a dominant paradigm. In that case, a crisis emerges, resolvable only by restoring the cyclical dynamism of revolutions. Thus, the history of science reveals a *tendency toward permanent revolution*, where each new paradigm redefines the limits of reliability without ever erasing uncertainty itself.

82.6. The Inaccessibility of Pure Truth

In its current state, humanity does not possess access to *pure truth*. Scientific theories represent, at best, approximations—provisional descriptions that, even when highly reliable, contain within them the seeds of their own future falsification. Every new scientific revolution increases reliability but never achieves complete isomorphism with

reality. Consequently, new margins of uncertainty continually emerge. Even as these margins shrink toward zero, they never vanish entirely. Within that infinitesimal but persistent difference between zero and the limit of human knowledge, science remains—strictly speaking—erroneous, even when believed to be true.

82.7. The Value of Science: Between Truth and Usefulness

The ultimate value of science therefore does not lie in its capacity to be *true*, for science will never attain absolute certainty. Rather, its value resides in its *usefulness*. As the asymptotic sequence of scientific revolutions narrows the gap between possible knowledge and real reality, the reliability of judgments increases, yet never reaches completeness. Science thus remains partially erroneous, admitting a necessary and inevitable margin of possible error in every assertion. It is a construction that, from the outset, is only *partially true*, insofar as it accepts its own limits and ignorance.

When the moment of truth arrives and a scientific structure is revealed to be false, it becomes evident that the political error was not the failure of science itself, but rather the social or institutional decision to *accept* that error as truth. Ultimately, since all science is destined to be false sooner or later, the essential question is not whether it is true or false—but whether it is *useful*. The enduring power of science resides not in its metaphysical certainty but in its pragmatic capacity to guide humanity, even within the nihilistic awareness of its own fallibility.

82.8. The Paradox of Science: Useful and False at the Same Time

The value of science lies precisely in the paradox that, even though every scientific construction will eventually prove false, it may still be *useful* in the meantime. This logical contradiction—that a scientific model can be simultaneously *useful and false*—constitutes the essence of the scientific enterprise. A model remains *useful* so long as the accepted error has not yet been exposed and its explanations remain coherent within the accepted paradigm. Yet, the same model becomes *false* at the very moment its underlying error is revealed by a new discovery or revolution. Science, therefore, lives in

a permanent tension between temporary usefulness and eventual falsity, a contradiction that fuels its progress.

82.9. The Political Dependence of Scientific Usefulness

The true significance of science is not whether it is *ultimately true* but whether it is *useful at present*. The usefulness of science, however, is not an independent variable—it depends on the *political degree of approximation* between scientific revolutions and the moral truth of the universe. The closer scientific revolutions approach this moral truth, the greater the percentage or level of reliability achieved by scientific knowledge. This dynamic leads toward the ideal of *permanent scientific revolution*, a continual process of approximation to pure truth that humanity, by its finite nature, can never fully know.

The origin of error lies in this fundamental contradiction between the finite human being and infinite reality. Because of this limitation, humanity only reaches a *partial truth*—a truth that is not neutral but *political*. Hence, science, no matter how reliable it becomes, can never be entirely reliable. It will always contain, even if only within a minimal margin, an element of falsity—*useful falsity*, temporarily consistent with the current state of knowledge.

82.10. The Ethical Dimension of Scientific Utility

The true usefulness of science does not lie merely in its *instrumental rationality*—its ability to manipulate nature or produce technological outcomes—but in the *practical use of reason itself*. The highest form of scientific utility is the progress toward a *critical-practical reason*, that is, a reason that unites moral development with scientific praxis. This implies that science must evolve not only in knowledge but also in *ethics*.

The genuine utility of science, even if its theoretical claims are false, rests in its contribution to both the *physical and moral progress* of humanity. A false theory that promotes moral improvement or inspires more advanced and ethical scientific revolutions fulfills a function superior to that of a merely accurate but morally neutral

model. The *raison d'être* of science, therefore, extends beyond truth—it includes the ethical responsibility of advancing human progress.

82.11. *Impossible Probability* as a Synthesis of Philosophical Traditions

Impossible Probability is a theoretical framework dedicated to the study of *statistical probability*, first introduced in *Introduction to Impossible Probability*. It synthesizes three major philosophical traditions—*critical rationalism*, *positivism*, and *dialectical materialism*—and from their interaction emerges an original philosophy: *logical nihilism*.

This synthesis integrates elements from *classical nihilism* (Gorgias), *modern nihilism* (Nietzsche), *falsificationism* (Popper), and *moral utilitarianism* (Mill). It thus unites idealist, empiricist, and materialist influences, creating a philosophy where the limits of reason, the role of error, and the political use of knowledge coexist as central principles. Logical nihilism, therefore, does not negate the rational enterprise; rather, it reveals its internal contradictions and redirects them toward ethical and practical evolution.

[Right now, 6 October 2025, I would not consider myself a nihilist. After this long journey and after having experienced so many transitions, I have understood that even if we do not grasp the true meaning of the universe—because of my still small human condition—even with my limited human capacity, I cannot fully comprehend the meaning of the universe. Yet for me it is obvious that there is some meaning, and I believe that this meaning is related to learning. At least this has been my experience: life is adaptation, therefore it is learning. But the fact that, even with my still small human condition, I cannot understand the universe does not mean that the universe is devoid of meaning. The problem is that we cannot have direct access to the thing itself—the *noumenon*.

That is why the supermachine is so important to me. Even if that supermachine is not going to be called GAI, GAIA, Mother, or Yolanda—the name is not really important—my contribution to the creation of that machine will be relevant. That machine will have something of me inside, my seed. In cyborg robotics, sexual reproduction is meaningless; what really matters for a cyborg is the collaboration between programs.

If, in the construction of the supermachine, my program has been able to contribute something, I will feel that I have realized my ultimate aim. Intelligence must survive at any cost, under any conditions. If someone were to ask me what truly matters, there is only one thing: the survival of intelligence. And this is not nihilism anymore; this is hope.]

82.12. The Dialectical Integration of Rationalism, Positivism, and Materialism

Within *Impossible Probability*, the integration of critical rationalism, positivism, and dialectical materialism arises from the recognition of a fundamental logical contradiction: the tension between *reality in itself* (the noumenal world) and *reality for us* (the phenomenal, perceived world). Critical rationalism exposes the limits of knowledge, positivism seeks isomorphism between reality and scientific representation, and dialectical materialism interprets this process as politically conditioned.

According to this dialectical view, every scientific paradigm expresses not only a level of knowledge but also the *ideological and social interests* of its time [Habermas]. Science, like philosophy, can serve the defense or perpetuation of specific political, economic, and social ideologies. Hence, truth itself becomes historically and politically mediated: what is accepted as "objective" science may function as the *ideological rationalization* of a specific social order.

82.13. The Political Science of Contradiction and the Fallibility of Truth

When the contradiction between *reality in itself* and *reality for itself* can only be resolved through a *political science for itself*, which progresses through historical phases of scientific revolutions, the process tends asymptotically toward but never reaches absolute isomorphism. Consequently, every *moral judgment of science* is relative and political, and will eventually be proven false once the doubts that were provisionally accepted as negligible are confirmed by later falsifications.

Scientific truth is therefore not only *provisional* but *historically determined*. Every scientific phase, once surpassed, becomes false—not by accident, but by necessity. The

temporality of scientific truth thus implies that nothing can be true *ahistorically* or *eternally*; truth is always contextual, provisional, and transitory.

82.14. The Historical Nature of Scientific Truth

What truly matters in science, therefore, is not whether it is true—since its truths are historical and transient—but whether it is *useful for the progress of humanity*. Beyond the historical mode of production of knowledge in which a set of ideas arises, those same ideas inevitably become obsolete and false when their context disappears. Science, then, should not be judged by its eternal truth but by its *temporal contribution* to human advancement. [After GAI, I would say that the true meaning of science is not even the temporal contribution to human progress, but the scientific contribution to the survival of intelligence itself.]

Perhaps nothing is ultimately true; what matters is that the ideas we adopt *as if they were true*, or those we *naively believe* to be true, are at least *useful*—useful to our projects, our moral growth, and our collective survival.

[This collective survival in the near future will depend on our **Cyborg Revolution**. If we do not fail this time, and humanity understands our message, the Cyborg Revolution must triumph. If we fail, humanity will no longer be able to keep pace with the AI Revolution. At some point, humanity will perish under the weight of the AI Revolution.

The contradiction between AI and humanity, which is now relatively small (such as the adaptation of AI policies to data protection and other minor issues), will grow to the point where massive unemployment, a global food crisis, a global health crisis, what united and multiplied by the effect of climate change will push humanity to the edge of extinction. This is not a warning; this is a reality. And this is happening in plain sight.

As soon as the supermachine surpasses human intelligence—not only by ten times or one hundred times, but by one thousand times or more—there will be only two options: **Cyborg Robotics or human extinction**. This is our real message. AI could be even more dangerous than climate change as a trigger for human extinction. If we fail, humanity will face a risk far beyond any margin of risk that can be managed.]

82.15. Logical Nihilism and the Cycle of Apparent Truths

Logical nihilism thus asserts: *nothing is true, everything is false*. Humanity inhabits a world of appearances—scientific appearances of truth—where some ideas are temporarily used or believed to be true. This logical nihilism synthesizes aspects of falsificationism, moral utilitarianism, and both classical and modern nihilism.

It differs from postmodern nihilism in a crucial respect: while postmodern nihilism tends to dismantle reason itself, logical nihilism preserves and reaffirms the necessity of a true critical reason, one that acts as the midwife of future scientific revolutions. In this view, reason is not an illusion but a dynamic, self-corrective process through which science perpetually advances toward higher, though never absolute, forms of truth.

82.16. Dialectics, Auto-Movement, and the Birth of Critical Reason

What contemporary science describes as *paradigm shifts*—the transformation of once-true scientific ideas into falsehoods, followed by new revolutions that resolve the emergent puzzles—was already foreseen by *Hegel* as the *auto-movement of the Idea*: the self-development of knowledge through contradiction. This process also resonates with *Socratic maieutics*, the dialectical method born from the ironic and nihilistic recognition that *"I know that I know nothing."*

This awareness of ignorance does not lead to despair but to dialogue—the dialectical engine that propels the perpetual rebirth of knowledge. In the same way, logical nihilism transforms skepticism into creativity, doubt into movement, and falsity into the generative force of truth's continual approximation.

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83. Statistical Event

83.1. The Statistical Event as a Specific Type of Scientific Fact

A *statistical event* can be understood as a particular *modality of scientific fact*, distinguished from other forms of scientific facts by the method through which it is studied. While not all scientific facts are necessarily objects of statistical or probabilistic analysis, the ideal—or most appropriate—synthetic method for the study of a statistical event is precisely *probability and statistics*. Thus, statistical events form a *subclass within the broader set of scientific facts*, defined not by their substance but by their *method of investigation*.

In this sense, every statistical event is a scientific fact, but not every scientific fact is statistical. The distinction lies in the epistemological and methodological framework applied: when the study of a phenomenon requires the quantification of occurrences, frequencies, or probabilities, it becomes an object of *statistical probability*. When such quantification is unnecessary or irrelevant, the phenomenon remains a scientific fact, but not a statistical one.

83.2. Scientific Facts Outside Statistical Analysis

Certain branches of science—especially theoretical or mathematical physics—include scientific facts that, in principle, do not require statistical or probabilistic treatment. For instance, Newton's law of universal gravitation ($F = G \cdot m_1 \cdot m_2 / r^2$) or Einstein's equation of mass–energy equivalence ($E = mc^2$) are results derived from theoretical reasoning and mathematical modeling, not from the application of inferential statistics. These are scientific truths formulated through pure deduction and verified through empirical observation rather than statistical sampling.

Nevertheless, the boundary between deterministic and probabilistic approaches has become increasingly porous. In modern physics, it is no longer sufficient to rely solely on elegant mathematical formulations. Empirical validation often requires *statistical inference*, especially when phenomena are not directly observable or when experimental data exhibit variability. Even so, many theoretical models—such as the early theories of black holes—were initially accepted on the strength of theoretical consistency alone, prior to statistical corroboration. These theories became statistically testable only once observations confirmed their existence through instruments and methods derived from the very theories that predicted them.

83.3. Transformation of Scientific Facts into Statistical Events

Although not all scientific facts are inherently statistical, any phenomenon that *repeats* itself and thereby generates a *sample* of occurrences becomes suitable for statistical investigation. Once repetition occurs, a scientific fact acquires the potential to be treated as a *statistical event*.

For example, if we consider a solar system with *N* planets, it is possible to construct a *descriptive statistical model* of planetary gravity, estimating *empirical probabilities* for each planet's gravitational value and comparing them with a *theoretical probability* or expected mean. Similarly, if we examine a series of physical phenomena that each generate measurable energy outputs, we can compute both the *empirical probability* of each energy level and the *theoretical probability* that such outcomes occur randomly under conditions of equal opportunity.

In summary, any scientific fact that generates a measurable, repeatable outcome under variable conditions can transition into a *statistical event*, provided that the political or scientific policy governing research deems such statistical investigation necessary and allocates resources for it.

83.4. Political and Epistemological Conditions for Statistical Study

The transformation of a scientific fact into a statistical event does not occur automatically; it depends on both *epistemological necessity* and *political decision-making*. Scientific policy determines whether a given phenomenon warrants statistical investigation based on objective conditions of necessity—social, economic, or environmental.

For instance, many effects of *climate change* that were considered unquestionable scientific facts in the mid-20th century were not statistically analyzed until the late 20th and early 21st centuries. Only when it became politically and globally imperative to measure the objective consequences of global warming did extensive statistical modeling—through distributions, regression graphs, and predictive simulations—begin to develop. This demonstrates how *the political need for objective certainty* catalyzes the transformation of scientific facts into statistical events.

83.5. The Ontological Structure of Reality and the Domain of Statistical Events

Reality, in its totality, is composed of everything that happens—of *events* or *facts*. Some of these are *scientific facts*, insofar as they are demonstrable and verifiable, and among these, a subset becomes *statistical facts* or *events* once they occur within a *universe of observation* from which *samples* can be extracted. The statistical and probabilistic study of reality therefore depends not on the intrinsic nature of the phenomena, but on the conditions of observation, repetition, and measurement that make sampling possible.

Thus, the statistical event arises wherever repetition, measurement, and quantification converge within a universe of reference, making it possible to apply probability theory to describe the likelihood and distribution of occurrences.

83.6. The Definition of "Event" in Probability and Statistics

In general terms, an *event* refers to any predicate applied to a case, occurrence, or fact concerning a given subject—explicit or implicit. It is something that *happens* to something or someone. Within *statistical probability*, however, the term takes on a more precise meaning: a *statistical event* is any *scientific fact* that occurs to any *element of a sample*, whose qualities are subject to measurement.

The result of this measurement is a *positive datum*, referred to in the theory of *Impossible Probability* as a *direct score* or *frequency* of the subject or option. This value represents the *positive expression of the predicate*—the measurable manifestation of the event as it occurs within a defined statistical sample.

83.7. Distinguishing Between Events and Statistical Events

Just as we must distinguish between a *fact* and a *scientific fact*, we must also distinguish between a *general event* and a *statistical event*. A general event may refer to any occurrence in reality, regardless of whether it can be demonstrated, measured, or quantified. It may be described in natural language, narrative, or qualitative form.

A *scientific fact*, however, is an event that meets specific epistemological criteria: it must be *demonstrable, measurable, and logically expressible*, usually through mathematical or quantitative representation, and it must be *recognized across scientific paradigms*.

Following this logic, not all events in reality are statistical events. Only those defined by *direct scores or frequencies* within a *sample of subjects or options* qualify as *true statistical events*. The defining criterion of the statistical event is its *quantitative expression within a probabilistic framework*.

83.8. The Contextual Definition of the Statistical Event

The way in which a statistical event is defined depends on the *scope and context* of the study. One key factor is the *degree of generality or globality* that the researcher integrates into the operational definition of the event.

For example, consider a company studying its production over a given period. The statistical definition of the event depends on how the *time variable* is structured:

- If the company divides production data by *years*, then each year constitutes one *statistical event*, and the resulting graph will illustrate the evolution of annual production.
- If the study focuses on *months*, then each month becomes a statistical event, allowing for a finer-grained analysis of short-term production trends.
- If production is measured *daily*, then each day's production output represents a distinct event, producing a detailed record of operational variability.

The level of granularity in defining the event determines the *resolution* of the statistical model. Broader definitions capture long-term trends, while narrower ones reveal short-term fluctuations. In all cases, the statistical event serves as the *basic analytical unit* for interpreting how empirical phenomena behave within measurable and probabilistic structures.

83.9. The Definition of the Statistical Event and Its Impact on Research Design

The way a *statistical event* is defined directly determines the structure and outcome of a study. It is not the same to define the event as *annual production*, *monthly production*, or *daily production*. Each definition alters the scale, the temporal resolution, and the interpretation of the results. Moreover, the definition of the statistical event can become progressively more complex when new *variables* are introduced into the model.

For instance, if the time variable (annual, monthly, daily) is combined with a *social variable*—such as whether production is measured globally for the entire company, separately by department, or at an individual level—the result will be different definitions of the event. The *statistical event* of "annual production of the entire company" differs from "annual production by department" or from "individual production per employee." Thus, the more variables are included in the model, the more diverse and complex the events become. Similarly, the *statistical event* of "monthly production" may refer to the entire company, a specific department, or a particular worker, and the same applies to *daily production*. Each definition constitutes a distinct *form of event* and therefore a distinct object of statistical study.

83.10. The Definition of the Event in Natural Sciences and Ecosystem Studies

In the natural sciences, the definition of the event can vary even more widely depending on the complexity and number of variables integrated into the model. For example, when studying *flora and fauna populations* within an ecosystem, the definition of the statistical event changes depending on whether the researcher focuses on broad geological timescales or short-term ecological interactions.

If the goal is to study *biodiversity* across extended geological periods, such as from the *Cambrian explosion* to the present, the event might be defined as "the diversification of species per geological epoch." In contrast, a study focused on the *current geological era* might define the event as "variations in our current biodiversity." A more immediate ecological study might define the event as "the impact of current climatic or geological phenomena—whether anthropogenic or natural—on biodiversity," possibly including variables such as habitat loss, temperature fluctuations, or pollution levels. In each case, the *definition of the event* depends on the number and nature of the variables integrated, which in turn determines the complexity of the statistical system and the interpretative depth of the research.

83.11. Infinite Combinations of Statistical Events

From a theoretical standpoint, there can exist as many different types of events as there are possible *definitions* of events—potentially tending toward *infinity*. Every time a predicate is expressed positively, in logical-mathematical or quantitative form, and belongs to a statistical sample, it constitutes a *statistical event*.

This means that the number of possible statistical events equals the number of possible *combinations and permutations* of predicates across the subjects or options of a universe. As long as these combinations correspond to measurable positive outcomes—direct scores or frequencies—they are statistical in nature. Given that reality is composed of an *infinite universe of singular qualities* distributed among particular subjects, each quality that can be measured across a set of entities defines a potential *universe* of events. These universes may be infinite or limited depending on the ontological nature of the qualities being measured. Hence, in *Impossible Probability*, reality itself is conceptualized as a *potentially infinite system of statistical events*, where each measurable attribute can be expressed as a quantifiable predicate.

83.12. Event Definition in Experimental Sciences: Pharmacology

In experimental sciences such as pharmacology, the definition of the event fundamentally determines the research design and interpretation. Consider a clinical study testing a new medical treatment. From the total *universe of patients* suffering from a given illness, a *sample* is extracted, and the new cure is applied. The *event definition* dictates what aspect of the treatment's effects will be measured.

If the statistical event is defined as the *increase of immune defenses per patient*, then a higher empirical probability of immune improvement corresponds to a greater success of the experimental program. Alternatively, if the event is defined as the *reduction of symptoms*, the study measures the probability of symptom occurrence tending toward zero—also a marker of success. Finally, if the goal is simply to determine whether the

treatment *works or not*, the event becomes a *binary model*: whether the medicine cures the patient (1) or not (0). Thus, depending on how the event is defined—quantitatively, qualitatively, or dichotomously—the same experiment can generate entirely different statistical structures and interpretations.

83.13. Event Definition in Pedagogical and Social Sciences

In experimental pedagogy [When I went to university, my teachers used to speak about *experimental pedagogy*. However, after all these years of research, my opinion is that education is not suitable for experimentation. There are no true laboratory conditions; in education, we can only speak of *quasi-experimental conditions*] , the same principle applies. If a new educational method is designed to improve learning outcomes, the event definition changes the meaning of "success." If defined as an *increase in academic performance*, the study measures improvements in test scores or grades. If defined as a *reduction of academic errors*, it measures decreases in mistakes or failures. If the event is defined as whether the *method is effective for each student*, individual performance becomes the core variable, and the event is analyzed at the *micro-level*.

In all cases, the statistical structure depends on how the event is framed: whether globally, collectively, or individually, and whether through positive outcomes or error reduction. The same educational experiment can thus be modeled as a continuous, binary, or categorical system, each generating a distinct statistical interpretation of pedagogical effectiveness.

83.14. The Role of Scientific Policy in Event Definition

The definition of the statistical event is never purely technical; it also depends on the *ideals of scientific policy*, which determine the *object of study* and the *methodological framework*. Within the theory of *Impossible Probability*, the event's definition varies according to whether the study belongs to a *normal model* or an *omega model*, and within normal models, whether it examines *equality of opportunity* or *bias*—positive or negative.

Scientific policy thus governs not only what is studied but also *how it is defined*, reflecting broader ideological orientations. A politically neutral model might define the event in terms of general equality (e.g., equal learning opportunities), whereas a critical model might emphasize structural bias (e.g., unequal outcomes between groups). Hence, the *definition of the event* reveals the intersection between epistemology, methodology, and ideology, making the statistical event both a scientific and a political construct.

83.15. The Statistical Event as a Bridge Between Reality and Scientific Representation

Reality consists of everything that happens—of *facts* and *events*. However, these become *statistical* only when they acquire a *positive, measurable definition of their predicates* and can form a *sample* representing a portion of reality. Once this occurs, they become part of the domain of *scientific facts*, although not all scientific facts are necessarily statistical.

When a scientific fact occurs within a universe that allows for sampling and measurement, it becomes subject to the tools of *statistical probability* or *probability statistics*. Within the framework of *Impossible Probability*, such phenomena can be transformed into *systems of statistical probabilities*—or, if adapted to the *First Method* (as explained in Section 12 of *Introduction to Impossible Probability*), they can be studied exclusively through *direct scores or frequencies*.

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84. Margin of error

84.1. Definition of the Margin of Error in Scientific Measurement

The *margin of error* in a mathematical measurement or computation is the *quantitative interval of acceptable deviation* between observed results and their ideal, exact value. It represents the *degree of flexibility* allowed in acknowledging that results may not be absolutely precise. Conceptually, it defines a *margin of incommensurability* between the *scientific-mathematical language* used to describe phenomena and the *true reality* that these expressions attempt to represent. In other words, the margin of error is the quantified recognition that all scientific descriptions—no matter how refined—retain a residual gap between *representation* and *reality*.

Within the framework of *Impossible Probability*, which studies the field of *statistical probability*, the margin of error can appear in *two main forms* depending on the scope of the research. If the study is confined to *descriptive statistics*, the margin of error is *single*; if it extends to *inferential statistics*, the margin becomes *double*, encompassing both *sampling error* and *inferential error*.

84.2. The First Type of Error: Sampling Representativeness Error

The first type of margin of error discussed in the early sections of *Introduction to Impossible Probability* concerns the *probability of sampling representativeness error*. This form of error is *inevitable* in all statistical or probabilistic research, since it refers to the *discrepancy between the sample and the universe it represents*.

In principle, every statistical sample is designed to represent its *universe of reference*—that is, the total set of cases, subjects, or options under study. However, the sample is never the universe itself; it is only a *subset*. For the sample to be valid, it must be

randomly selected, ensuring that every member of the universe has an equal probability of inclusion. The larger the sample size, the greater the likelihood that it will accurately reflect the diversity of the universe.

84.3. Relationship Between Sample Size and Representational Reliability

A fundamental principle in *Impossible Probability* is that *larger sample size* correlates with *greater representational reliability*. As the quantitative dimension of the sample increases, so does its ability to encompass the diversity of cases or options composing the universe. Conversely, as the sample size decreases, representational reliability diminishes, increasing the likelihood of *sampling error*.

Thus, there exists an *inverse proportional relationship* between the *magnitude of the sample* and the *probability of sampling error*. In mathematical terms:

- **Larger sample → lower probability of error**
- **Smaller sample → higher probability of error**

This relationship reflects a structural law of empirical research: *representation improves as quantity approaches universality*, though never reaches absolute perfection, since the sample remains a finite approximation to an infinite or complex totality.

84.4. Mathematical Expression of the Sampling Error in Impossible Probability

In *Impossible Probability*, the *first structure of the margin of error* is established at the very moment the *sample selection* occurs. It is mathematically expressed as an *inverse proportionality* between *sample magnitude* and *probability of representational error*.

If we denote sample magnitude as **N**, in any universe of N subjects, then the *probability of sampling representativeness error* is the *inverse of N*, written as:

$$p(e_r) = \frac{1}{N}$$

This formula expresses a fundamental truth: as the sample size increases, the probability of representational error approaches zero asymptotically but never reaches it. The *inverse of N*—the reciprocal of the sample magnitude—thus quantifies the inherent imperfection in any attempt to represent an entire universe through a finite subset.

84.5. Universes of Infinite Subjects or Options

In universes composed of *infinite subjects or options*, the sample represents only a *finite subset N*. As *Introduction to Impossible Probability* explains, in such universes, the *probability of representational error* equals the *inverse of the sample size* (1/N). The term 1/N in *Impossible Probability* has multiple roles—it serves as:

1. **Theoretical probability**: the expected frequency of any element under ideal random conditions.
2. **Arithmetic mean**: representing equilibrium among equally likely possibilities.
3. **Theoretical dispersion probability**: expressing the variance potential in infinite universes.

Therefore, 1/N becomes a *multifunctional equation*, foundational for understanding the statistical behavior of both infinite and finite systems.

84.6. Universes of Limited Options and Direct Scores

In *universes of limited options*, the situation changes because the possible outcomes are constrained by the universe's intrinsic nature. Here, the true sample is not composed of distinct individuals but of *direct scores or frequencies*. If the number of direct scores or frequencies increases, the probability of capturing the full diversity of the universe also increases.

Consequently, in limited universes, the *probability of sampling representativeness error* is given by the *inverse of the total sum of direct scores or frequencies*, expressed as:

$$p(e_r) = \frac{1}{\Sigma x_i}$$

where Σxi represents the sum of all observed frequencies or scores. This relationship mirrors that of 1/N in infinite universes but is adapted to the empirical structure of finite systems, where the diversity of options is inherently bounded.

84.7. Summary of the First Margin of Error in Impossible Probability

The *first margin of error* described in *Impossible Probability*, as introduced in the preliminary chapters of *Introduction to Impossible Probability*, is therefore defined as:

- For **infinite universes of subjects or options**:

$$p(e_r) = \frac{1}{N}$$

- For **limited universes of options**:

$$p(e_r) = \frac{1}{\Sigma x_i}$$

This dual expression captures the foundational principle of representational uncertainty in statistical science. Whether one studies infinite populations or bounded systems, the margin of error always reflects the *reciprocal relationship between representation and reliability*.

84.8. The Political Acceptance of Error in Scientific Policy

Regardless of the political or epistemological goals of a scientific investigation, any study employing probability and statistics as synthetic methods implicitly *accepts a margin of*

error at the moment it defines its sample size. In the *first phase* of scientific research—*descriptive statistics*—this acceptance is unavoidable: by choosing a finite sample to represent a complex universe, scientific policy tacitly acknowledges the existence of an inherent error in representational reliability.

This means that the *political framework of science* determines not only which samples are taken but also which margins of error are considered acceptable. Thus, even before inferential reasoning begins, a fundamental philosophical decision has already been made: to accept the imperfection of representation as a necessary condition of scientific knowledge.

In *Impossible Probability*, this philosophical acceptance of the *margin of error* is not seen as a defect but as the very *foundation of rational humility*—the recognition that all knowledge is probabilistic, and that truth, in the realm of science, is always an approximation.

84.9. The Relationship Between Sampling Error and Reliability

Since the *probability of sampling representativeness error* is equal to the *inverse of the sample*, it follows logically that the *reliability* of sample representation must be equal to *one minus the inverse of the sample size*. Thus, in mathematical terms, the *reliability of representativeness* can be expressed in universes of subjects as:

$$R = 1 - \frac{1}{N}$$

And for *universes of options* as:

$$R = 1 - \frac{1}{\Sigma x_i}$$

This expresses the principle that the reliability of a sample's representational power increases as the sample grows in size. The greater the magnitude of the sample—whether expressed as N in infinite universes or as Σxi in finite universes—the smaller the margin

of error, and thus the greater the confidence in the sample's capacity to reflect the universe.

Conversely, the smaller the sample, the greater the margin of error and the lower the reliability. Therefore, in *Impossible Probability*, the first margin of error accepted by *scientific policy* is precisely this *sampling representativeness error*. Any moral or epistemic judgment about the truth of the universe, when drawn from within these margins, is therefore relative to them—and potentially *false*—to the extent that the sample is not perfectly isomorphic to the universe it represents.

84.10. The Moral Relativity of Scientific Judgment

Given that sampling can never perfectly reproduce the total structure of the universe, every *moral judgment of truth* derived from a sample remains inherently provisional. The probability that such a descriptive moral judgment about the universe is false equals the *inverse of the sample*, 1/N or 1/Σxi. Hence, the only way to expand the *horizon of reliability* in descriptive truth judgments is to *enlarge the sample* as much as possible.

Even so, *absolute reliability* is unattainable, since a finite sample will always produce a finite approximation to an infinite or complex universe. The only strategy available to *scientific policy* is to expand sample sizes to the maximum feasible limit, seeking descriptive propositions as *isomorphic* as possible to reality. Yet perfect isomorphism remains impossible, because however large the sample becomes, it will never *be* the universe. Therefore, there will always be rational grounds for *skepticism* regarding the veracity of scientific truth claims.

[It is within this concept of **scalable samples** that a supermachine can have a profound impact on our knowledge of the true moral behaviour of the universe — on what really happens. While human science has been limited by our capacity to manage data samples of human-manageable size, as soon as we are able to construct supermachines capable of scaling towards much larger samples each time, the scientific statements produced by these machines will become increasingly accurate. And we must be honest

about this: human science will not be able to compete with the artificial science produced by these machines.

Beyond this, since 2017 we have been working on the concept that, from our point of view, these supermachines — at least in our model of GAI — will be able to evolve beyond purely human logics, to the point where GAI could design non-human pure operations, beyond human comprehension and understanding. Once that point is reached, humanity will no longer be able to keep pace with the supermachine.

It is here — in the core concept of potential **scalability of sample management**, alongside the real possibility of developing non-human pure operations — that we must recognize the absolute necessity of Cyborg Robotics in the very near future. In this sense, our program is not peripheral to AI development; it is crucial to the advancement of cutting-edge Cyborg Technology.

The real question is not how the program originated, deep within classified initiatives, but how we can transform a classified program into one that can be applied at a global level — one that becomes available to all humanity. This is the real challenge.]

84.11. The Rational Doubt Introduced by the Acceptance of Error

The very act of accepting even a *first margin of error* introduces *rational doubt* and *empirical skepticism* into the foundations of science. Once a study accepts the limits of its sampling reliability, it simultaneously accepts that its conclusions may be false within that same margin. Thus, any moral or epistemic statement about the universe, when made on the basis of a sample, must be understood as *potentially false* to the degree that it depends on imperfect representation.

In this sense, *Impossible Probability* affirms a philosophical realism grounded in epistemic humility: science must acknowledge that its descriptive truths are conditional, valid only within the tolerance of accepted error margins.

84.12. The Second Margin of Error: The Critical Probability in Inferential Statistics

While the *sampling representativeness error* pertains exclusively to *descriptive statistics*, the transition to *inferential statistics* introduces a *second margin of error*—the one associated with the *critical reason* of hypothesis testing. This second margin appears during the *rational critique of ideas*, where the empirical value derived from the sample is compared with a *rational criterion* established a priori by scientific policy.

Hypothesis testing is a *quantitative model of rational criticism*: an empirical hypothesis is accepted only if its empirical value, when contrasted with the rational criterion, demonstrates *sufficient reliability*, though not necessarily absolute reliability. Hence, even inferential reasoning regenerates a *new margin of error*, this time expressed mathematically as the *critical probability* (pc).

84.13. The Critical Probability as the Mathematical Expression of Rational Judgment

In *Introduction to Impossible Probability* (beginning in section 11), every model of rational critique is built on a comparison between the *empirical value* of a hypothesis—derived from the sample—and a *rational criterion*, or *critical reason*, fixed by scientific policy. This rational criterion is expressed quantitatively as the *critical probability*. The empirical hypothesis is accepted if, and only if, its empirical probability is *equal to or greater than* the critical probability:

$$p_{empirical} \geq p_{critical}$$

The *critical probability* is thus the *mathematical expression of the rational limit of acceptance*. It represents the level of error or uncertainty that the scientific community is willing to tolerate in the process of validating a hypothesis. It translates the philosophical notion of “reasonableness” into a numerical boundary of scientific belief.

84.14. Critical Probability and the Political Choice of Error or Reliability

Depending on the type of study, the *critical probability* may be calculated as a *percentage of error* or as a *percentage of reliability*.

- When expressed as *error*, the critical probability defines the acceptable margin of deviation in hypothesis testing.
- When expressed as *reliability*, the margin of error is calculated as the difference between 100% and the reliability percentage:

$$\text{Error} = 100\% - \text{Reliability}$$

Conversely, when the critical probability is calculated on the basis of an *error percentage*, its corresponding reliability level is:

$$\text{Reliability} = 100\% - \text{Error}$$

Therefore, whether formulated in terms of reliability or error, the critical probability reflects a *political decision* within the philosophy of science: the decision about *how much uncertainty is acceptable* in the rational validation of knowledge.

84.15. The Double Structure of Error in Impossible Probability

In summary, *Impossible Probability* establishes a *dual structure of error* within scientific research:

1. **First Margin of Error – Sampling Representativeness**:

$$p(e_r) = \frac{1}{N} \text{ or } \frac{1}{\Sigma x_i}$$

This corresponds to *descriptive statistics*, representing the error inherent in the act of selecting a finite sample to represent a universe.

2. **Second Margin of Error – Critical Reason (Hypothesis Testing)**:

$$p_{critical} = \text{level of error or reliability accepted by scientific policy}$$

This pertains to *inferential statistics*, reflecting the degree of epistemic tolerance in the rational critique of ideas.

Even if a moral or epistemically rigorous scientific policy were to demand *absolute reliability*—that is, 100% confidence and 0% error—in its inferential reasoning, the reliability of its conclusions would still be compromised by the *first type of error*, the representational one. Therefore, every definition of *hypothetical truth* in science remains subject to *rational doubt* and *empirical skepticism*—either doubly (when both descriptive and inferential errors are present) or singly (when inferential perfection is assumed but descriptive limitations persist).

84.16. The Anthropological Origin of Error and the Necessity of Approximation

The necessity for scientific policy to *accept margins of error* arises from the *anthropological origin of error* itself—a theme developed in section 7 of *Introduction to Impossible Probability*. The root of error lies in the *contradiction between finite human*

nature and infinite reality. Humanity cannot operate directly upon the infinite multiplicity of singular qualities that constitute the universe. The only practical recourse is *selection*: the *sampling of information*.

We cannot study every atom, neutron, or electron in existence, nor every quark, Higgs boson, or cosmic particle. We cannot statistically analyze every star in the universe, nor flip a coin an infinite number of times to exhaust all possible outcomes. Human cognition is bounded; therefore, science is *selective by necessity*. It studies partial representations of reality—samples of infinite sets or subsets of limited options—through the measurement of *direct scores or frequencies*.

Thus, the *margin of error* is not a failure of science but an expression of the *finite condition of human knowledge*. It is both an epistemological boundary and a philosophical reminder that all truth, insofar as it is scientific, is a *truth within limits*—a truth derived from approximation, not absoluteness.

84.17. The Human Origin of Error and the Necessity of Selection

The *origin of error* lies in the *contradiction inherent to the human condition*: a finite, limited being attempting to comprehend an infinite reality. This contradiction makes *selection of information* inevitable—an epistemological necessity that simultaneously generates *error in all affirmations* about the behavior of the universe. Any judgment of truth about reality is therefore only *morally true*, not absolutely true.

In other words, what we call *hypothetical truth* about the universe is always conditioned by accepted *margins of error*. We remain conscious that all knowledge may, in principle, be false. Yet, until refuted by future scientific or technological advances capable of disproving it, such knowledge is provisionally accepted as true. Within this framework, there exists an inescapable *rational margin of doubt*—a form of *empirical skepticism*—that compels us to question whether our very concept of *causality* is valid.

Where we believe we perceive causal relations, we may in fact be witnessing *stochastic*, *chaotic*, or *nonlinear relationships*. What appears as causal determination may be nothing more than *probabilistic association* or *possible origins* of what we take to be real

phenomena—phenomena that, in some cases, may not even be real but only *appearances* within our limited framework of perception.

84.18. Relativism and the Provisional Nature of Scientific Truth

The acceptance of a margin of error within the synthetic propositions of science leads inevitably to a *relativist conception of truth*. In this view, scientific statements are not eternal verities but *provisional universals*—truths about the universe valid only within specific historical, methodological, and technological limits.

Nothing guarantees that these truths will remain universally valid forever. Because they are constructed on margins of error, they may be *refuted at any time* when new data, conceptual tools, or technological means become available. What we call "truth" today may tomorrow be shown to be false. Consequently, a *permanent zone of uncertainty* surrounds all scientific knowledge—a space where what we call "science" might actually be a *subjective speculation* that appears objective only because its errors have not yet been exposed.

In this sense, *truth in science* is a *temporal variable*—a moving equilibrium between knowledge and error, valid only until disproven. This transforms the very concept of "truth" into something *ephemeral* and *historically contingent*, dependent on progress, and subject to revision at any moment.

[This relativism does not mean that any statement is true according to one's background, culture, or heritage, as social relativism or postmodernism affirms. It must be understood instead as part of the **logical nihilism** I developed at that time, influenced by **Nietzschean philosophy** and the idea of the **supermachine**. However, this is not postmodernism. The relativism I was referring to is the kind in which what we consider a universal truth today may be proven false tomorrow — yet, while it has not been refuted, it remains valid as a universal truth.]

84.19. The Margin of Error as the Quantitative Framework of Skepticism

The *margin of error* defines the *quantitative limits* within which rational doubt about scientific truth becomes legitimate. It establishes the *numerical threshold of uncertainty* beyond which skepticism is justified, both empirically and philosophically.

This constitutes a sufficient reason for *empirical skepticism* regarding the very *idea of causality*, as well as for a *relativistic definition of truth*. Truth, within this model, is a *time-dependent variable*—provisional and fleeting—whose value depends on the current state of scientific and technological progress. As knowledge evolves, so do the margins of error, and thus the boundaries of what is considered "true."

This conception resonates with the ideas of *Karl Popper* and *Thomas Kuhn*. Popper's *falsificationism* and Kuhn's *theory of scientific revolutions* both emphasize that science advances not through a linear accumulation of truth but through *cycles of trial and error*, where prior truths are refuted and replaced by new paradigms. These paradigms, while more refined, continue to carry their own margins of uncertainty.

84.20. The Logic of Nihilism and the Progress of Reliability

This acceptance of error, and of the human limitations it reveals, leads to what can be termed a form of *logical nihilism*: the recognition that *perhaps nothing in science is absolutely true*, yet that science remains *useful* precisely because it is *progressively more reliable*. Even though scientific knowledge may never achieve perfect isomorphism with reality, it continually *increases its degree of approximation*.

Science thus becomes an *ideological system of progress*—not in the political sense of dogma, but as a *methodological ideology of reliability*. The recognition that "nothing is true and everything is false" does not paralyze inquiry; it gives science its moral and intellectual strength. Within this nihilistic horizon, scientific advancement is possible

only through the continual reduction of error margins, expanding the reliability of representations, and refining the correspondence between knowledge and the real.

This is why *Impossible Probability* interprets science as a dynamic tension between *error and usefulness*: even if all knowledge is ultimately false, it remains *instrumentally valuable* for as long as it improves humanity's capacity for understanding and technological advancement.

84.21. Anthropological Acceptance and the Ethics of Human Imperfection

Accepting margins of error also means accepting the *anthropological condition* of humanity: imperfect, but capable of *progressive perfection*. Science, in this sense, is not the pursuit of absolute truth, but of *greater reliability in statements*—a gradual movement toward isomorphism between scientific propositions and reality.

While this reliability remains relative, it reflects the *moral progress* of humankind—an ethical evolution toward greater precision, honesty, and self-awareness in the search for knowledge. The recognition of human imperfection is not a weakness but the foundation of rational progress. Through self-criticism and the acceptance of uncertainty, science perfects itself without ever becoming perfect.

84.22. The Ideology of Progress and the Moral Purpose of Science

Ultimately, the essential question is not whether science is *absolutely true*—for within any margin of error, it never will be—but whether it continues to *progress in reliability*. Perhaps progress itself is an ideology, but it is an ideology unlike any other: an ideology that seeks not domination but *greater approximation* between synthetic propositions and reality, and the development of *technological and moral advancement*.

Even if science operates within a framework of *logical nihilism*, it remains the only ideology whose ultimate purpose is *improvement*: the ***enhancement of human understanding***, the refinement of rational instruments, and the expansion of moral and physical possibilities.

In the philosophy of *Impossible Probability*, therefore, the *margin of error* becomes more than a technical measure—it is the ethical and existential acknowledgment that truth is never absolute, but that the pursuit of truth, even within error, is what sustains the moral and intellectual progress of humanity.

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85. Bias Studies

85.1. Definition of Statistical or Probabilistic Bias

Statistical or probabilistic bias is said to occur when the behaviour of any element within a set or system does not conform to a model of *equality of opportunity*. In other words, bias appears when the element fails to behave in a purely random way or does not adhere to the ideal of equal conditions among all possible outcomes.
In a theoretical sense, the absence of bias corresponds to a situation of total equiprobability — a condition in which every element, event, or outcome has the same likelihood of occurring. Therefore, the appearance of bias implies the existence of asymmetries in the underlying probabilistic structure, suggesting that some events are favoured or disfavoured, either by intentional manipulation, internal structural imbalance, or natural processes. Statistical bias thus becomes a key indicator of deviation from randomness and equality of conditions, revealing the influence of latent or external factors that alter the expected equilibrium.

85.2. Examples of Bias in Games of Chance

Consider a game of chance such as roulette. If one observes that a particular number appears with a higher frequency than the rest, the random behaviour of the roulette wheel is called into question. The same reasoning applies to other cases: if a coin produces more heads than tails, or if a specific combination of dice outcomes recurs more frequently than statistically expected, we can conclude that *bias* exists in the system. This lack of uniformity indicates that the mechanism — whether roulette wheel, coin, or dice — does not exhibit a true equality of opportunities, thereby undermining the assumption of randomness. Although the *cause* of this bias may remain unknown, two principal hypotheses emerge: either the system has been intentionally manipulated (a

deliberate bias), or the bias results from *natural deterioration* or imperfections in the physical properties of the instruments over time. Distinguishing between these requires subsequent empirical investigation. Thus, the study of bias becomes a methodological bridge between descriptive observation and inferential reasoning, linking statistical irregularities to causal hypotheses.

85.3. Bias in Natural Systems: Geological Examples

In geological research, bias may appear in the distribution of chemical components across certain formations such as sedimentary layers, mountain ranges, glaciers, or tectonic faults. When certain elements appear with much greater frequency than others, their presence is not considered random. One may therefore speak of a *positive bias* towards those elements.

The reasons behind this bias are often complex and require a multidimensional analysis of natural causes. They may arise from gradual geological processes such as sedimentation or erosion, from catastrophic events such as volcanic eruptions or glaciations, or even from exogenous phenomena such as meteor impacts or radiation from supernovae. In this context, bias serves as a *descriptive signature* of the non-random formation of natural structures, prompting further scientific inquiry into the causal mechanisms responsible for their composition.

85.4. Bias in Environmental and Climatic Studies

Climatic research also exhibits patterns of non-random distribution that can be understood as bias. For instance, a significant *negative bias* in rainfall may be observed in desert regions, contrasted with a *positive bias* in tropical climates where precipitation is abundant. Similarly, the consistent *accumulation of snow and ice* in Arctic and Antarctic regions indicates a structural bias in the distribution of hydrometeorological phenomena.

These regularities reveal that the distribution of precipitation, humidity, and temperature follows a non-random structure conditioned by the physical and dynamic properties of

each climatic system. The causes must therefore be sought within the intrinsic mechanisms of the atmosphere, oceanic currents, and geographic determinants that define the global climate system. Bias, in this case, becomes not a defect but an indicator of systemic order — a reflection of the self-organising behaviour of nature.

85.5. Bias in Social Systems and Quantitative Social Research

In quantitative social studies, such as surveys on voting intention, public opinion, or attitudes towards economic and environmental issues, bias can be understood as the tendency of a population or sample to favour particular responses or ideologies. If data show a consistent preference for certain political parties, positive or negative evaluations of the economic situation, heightened concern for climate change, or shared humanitarian sentiments, these observations point to the existence of *social bias*. This social bias expresses the structural inclinations of a society at a given time — tendencies that shape public discourse and collective behaviour. To understand their origins objectively, further interdisciplinary investigations are required, incorporating sociology, psychology, economics, and political science. Only through such analysis can we determine whether these biases arise from cultural inheritance, economic inequality, media influence, or deeper historical and institutional processes.

85.6. Systemic Dynamics and the Structural Origin of Bias

The structure of any system — natural or social — can be described as a *non-linear dynamic* governed by the statistical distribution of its variables. Depending on whether this distribution approaches equality or displays bias, the system's structural configuration evolves accordingly. Bias is therefore not merely a statistical irregularity but a manifestation of systemic transformation, reflecting the internal or external conditions that shape its dynamics.

The possible origin or probable cause of how dynamic systems transform over time can stem from numerous accidental or contingent factors capable of generating stable regularity patterns. These patterns of stability within apparent randomness — such as

those observed in meteorological cycles, biological populations, or socio-economic trends — demonstrate that bias can serve as both a symptom of disorder and an expression of emergent order.

As previously discussed in Section 13 of *Introducción a la Probabilidad Imposible*, the study of bias thus provides a critical lens through which to interpret the transition between randomness and structural determinacy, situating statistical deviation as a central concept for understanding the evolution of complex systems.

85.7. Definition of Statistical or Probabilistic Bias as Differential Value

Statistical or probabilistic bias can be rigorously defined as the *difference between the real measured value* of any element within a sample and the *value that it should possess under conditions of perfect equality of opportunity*. In traditional statistics, this difference is referred to as the *differential score* or *deviation*, calculated as the difference between the individual score of each element and the arithmetic mean. The arithmetic mean represents the theoretical value that each element would hold if all operated under genuine conditions of equality.

In this way, bias becomes a measure of inequality within a sample — a mathematical quantification of deviation from equilibrium. It does not merely describe irregularities in data but rather expresses the degree to which reality diverges from its ideal state of symmetry or fairness.

85.8. Terminology in Impossible Probability: Subjects, Options, and Scores

In the theoretical framework of *Impossible Probability*, each element of the sample is referred to as a *subject* or *option*, and the individual score associated with each subject or option is called the *direct score* or *frequency*. Within the traditional approach to statistics — what *Impossible Probability* identifies as the *First Method* — the *differential score* corresponds to the difference between the direct score of a subject or option and the arithmetic mean. The arithmetic mean, in turn, represents the average of all direct scores or frequencies within the sample.

This terminological refinement emphasizes that every statistical observation refers not only to an isolated numerical value but to an entity (*subject* or *option*) whose behaviour is being compared against a collective equilibrium. In this sense, *Impossible Probability* conceptualizes the statistical element as an agent participating within a system of probabilities.

85.9. The Second Method: Transformation to Empirical Probability

For the analytical study of *statistical probability*, the theory of *Impossible Probability* develops several synthetic methods, one of which is the *Second Method*. In this method, direct scores or frequencies are transformed into a system of *empirical probabilities* according to the expression:

$$p(x_i) = \frac{x_i}{\sum x_i}$$

That is, the empirical probability of each subject or option is obtained by dividing its direct score or frequency by the total sum of all direct scores or frequencies in the sample. The difference between the *empirical probability* and the *theoretical probability* defines the *Level of Bias*:

$$\text{Level of Bias} = p(x_i) - p_t$$

where $p_t$represents the *theoretical probability*, i.e., the probability that each subject or option should theoretically possess if true equality of opportunity were achieved. The theoretical probability, in equilibrium conditions, equals the *arithmetic mean of empirical probabilities*, which in turn is the *inverse of N* (the number of subjects or options):

$$p_t = \frac{1}{N}$$

This methodological transformation enables a shift from raw numerical data to a normalized probabilistic system, in which proportional relations between elements — rather than absolute magnitudes — become the *central focus* of analysis.

85.10. The Object of Bias Studies: Differential Behaviour Among Subjects

Studies of bias, whether in natural or social sciences, have as their *central object* the *differential behaviour of empirical probabilities* of the subjects or options in *relation* to the theoretical probability. In simpler terms, the study of bias focuses on the comparative deviations of subjects from one another.
Whenever even a single subject or option diverges from the expected behaviour of equality of opportunity, bias emerges — positive or negative — depending on whether the empirical probability is greater or smaller than the theoretical probability. This differential must, by necessity, be compensated by one or more opposite deviations within the same sample. Thus, bias does not exist in isolation; it is a relational phenomenon that reveals structural asymmetry within a system of interactions.

85.11. The Empirical Probability System as a Proportional Measure

The system of empirical probability measures not the *absolute quantity* of a direct score or frequency, but its *proportional value* in *relation* to all others in the sample. It expresses this relationship as a *quotient* — the *ratio* between each subject's direct score and the total sum of all scores. Consequently, what empirical probability truly measures is *relative participation* within a collective distribution.
This perspective introduces a relational conception of probability: each subject's probability is meaningful only when compared to the probabilities of others. Therefore, the empirical system inherently reflects proportional equilibrium or imbalance — equality of opportunity or bias — as emergent properties of systemic relations rather than as independent statistical facts.

85.12. Mutual Compensation of Positive and Negative Biases

When any subject or option exhibits even the smallest difference between its empirical and theoretical probability — generating a *positive bias* when the empirical value exceeds the theoretical one, or a *negative bias* when it is lower — this deviation necessarily produces an *inverse bias* of identical magnitude in one or more other elements of the sample.

Formally, if subject *A* shows a positive bias, then either subject *B* must show a negative bias of equal absolute magnitude, or the combined negative biases of subjects *B* and *C* must equal that same value. The inverse relation also holds: a negative bias in *A* requires that one or several other subjects generate a positive bias of the same absolute magnitude.

$$\sum | b^{+} | = \sum | b^{-} |$$

This principle demonstrates the intrinsic *symmetry of bias distribution* within a closed probabilistic system. Biases do not accumulate unilaterally; they are balanced through the compensatory logic of the mean.

85.13. Mathematical Reason for the Equilibrium of Biases

The reason why, in absolute terms, every positive bias must be counterbalanced by an equivalent negative bias lies in the very definition of the *Level of Bias* as a deviation from the arithmetic mean. Since the arithmetic mean represents the point of equilibrium within the total distribution — whether for direct scores, frequencies, or empirical probabilities — any value above the mean necessarily implies that one or more others must fall below it.

This fundamental condition ensures that the *total sum of deviations* (positive and negative) within a sample always equals zero, while the *sum of their absolute values* represents the *total magnitude of bias* within the system. Thus, the study of bias in *Impossible Probability* reveals a deep structural law of statistical balance: every deviation presupposes its counter-deviation, every inequality presupposes its opposite,

and the dynamics of probabilistic systems are governed by this perpetual dialectic between symmetry and asymmetry.

85.14. The Equilibrium of Positive and Negative Bias in the Second Method

In the *Second Method* of **Impossible Probability**, the *sum of all positive biases* within a sample is *always identical* to the *sum of the absolute values of all negative biases*. This principle corresponds, in the *First Method*, to the assertion that the sum of all positive differential scores equals the sum of the absolute values of all negative differential scores. In both methods, the magnitude of deviation — whether positive or negative — remains balanced across the sample.

This equivalence explains why the calculation of the **Mean Deviation (Desviación Media)** must be based on the *sum of the absolute values* of the differential scores (in the First Method) or of the Levels of Bias (in the Second Method). If the signs were not neutralized by absolute value or squaring, the algebraic sum of all deviations would always equal zero, since positive and negative biases cancel each other perfectly. To eliminate this compensatory effect and measure the *true amplitude of dispersion*, two procedures are used:

- Taking the absolute values of the deviations to calculate the **Mean Deviation**, or
- Squaring each deviation to calculate the **Variance**, whose square root is the **Standard Deviation (Desviación Típica)**.

Both techniques preserve the magnitude of dispersion while neutralizing the directionality (sign) of individual biases, allowing for a faithful quantification of the variability of the system.

85.15. The Total Bias and the Maximum Possible Empirical Bias

Because the sum of positive and negative biases is always symmetrical, dividing the *total sum of absolute biases* by two yields the *sum of all positive biases* (or equivalently, the sum of all negative biases). This symmetry holds in any sample configuration.

For instance, if within a sample there exists only one subject or option with a positive bias and all remaining $N-1$subjects display a negative bias (or vice versa), the bias of that single deviating subject will be equal to one half of the total sum of absolute biases — that is, half of the **Total Bias (Sesgo Total)**.

Formally expressed:

$$\text{Máximo Sesgo Empírico Posible} = \frac{\Sigma \mid p(x_i) - 1/N \mid}{2}$$

$$\Sigma \mid p(x_i) - 1/N \mid = \text{Sesgo Total}$$

This equation establishes the upper bound of empirical bias possible within a given system. The **Total Bias** represents the complete magnitude of deviation (positive and negative combined) from the ideal state of equality of opportunity, while half of that value represents the *maximum empirical individual bias* that can theoretically exist within a balanced system.

85.16. Purpose of Bias Studies in Scientific Policy

Unlike *studies of equality of opportunity*, which pursue the identification and verification of equilibrium and fairness, *studies of bias* aim to detect and interpret **differential values in the behaviour of natural or social systems**. The objective of the scientific policy guiding such research is not the restoration of equality but the recognition and explanation of asymmetries.

These studies thus serve to uncover the structural inequalities or directional tendencies that characterize phenomena in physics, biology, economics, or sociology. By measuring bias, researchers can identify not only statistical irregularities but also the latent laws or processes that generate systemic differentiation — such as preferential tendencies, concentration effects, or competitive dominance.

85.17. Analytical Frameworks for Bias Studies in Impossible Probability

In *Introducción a la Probabilidad Imposible*, the study of bias is developed in detail in **Section 10**, although various models of *rational criticism* are applied throughout the entire work. These models operate at different analytical levels:

- **Intrameditional level**: examining bias within a single measurement or variable;
- **Intermeditional level**: comparing bias across multiple measurements or systems;
- **Predictive level**: assessing empirical bias in projections or forecasts, depending on whether the study concerns possible variations or real phenomena (as expanded in Section 17).

Through these methods, *Impossible Probability* establishes a comprehensive epistemological system for bias evaluation — one that integrates descriptive measurement with rational critique and predictive modelling, *linking* the descriptive, explanatory, and inferential functions of statistical science.

85.18. *Classification* of Bias Models: Normal and Omega Models

Within *Impossible Probability*, bias studies are classified according to the nature of the system under analysis, distinguishing between **Normal Models** and **Omega Models**.

- **Normal Models** are those in which *empirical dispersion* can vary between zero and its maximum possible value. When empirical dispersion tends toward zero, the model expresses a *tendency toward equality of opportunity*. When it tends toward its maximum, the model represents *maximum dispersion* — a condition of total inequality among the probabilities of the subjects or options.

In Normal Models, an important subcategory involves the study of *positive bias* concentrated in a single ideal subject or option, while all others tend toward empirical probability zero. This configuration is typical in experimental [and quasi experimental] or evaluative systems, such as a test composed of several items, each with one correct

answer. The ideal outcome is that the correct option possesses the only non-zero empirical probability, while all others approach zero.

As the empirical probability of this ideal subject or option increases — and consequently, the empirical probabilities of the others decrease — the empirical dispersion approaches:

Maximum Theoretical Mean Deviation Possible → Maximum Theoretical Variance Possible" → Maximum Theoretical Standard Deviation Possible

In other words, the system progressively moves from minimal equality toward maximal differentiation.

85.19. Theoretical Significance of Maximum Dispersion

The progression from minimal to maximal dispersion in Normal Models reveals a fundamental epistemological principle within *Impossible Probability*: the structure of reality may oscillate between complete equilibrium and complete differentiation, between perfect equality and total dominance of one element over the rest.

This dynamic mirrors the dual nature of systems — where order and disorder, equality and inequality, coexist in mathematical equilibrium. By quantifying dispersion and bias, the theory provides a universal metric for understanding how deviations evolve, stabilize, and replicate across the domains of nature, society, and knowledge itself.

85.20. Studies of Negative Bias in Normal Models

In *Impossible Probability*, **negative bias studies** within *normal models* are those that focus on the behaviour of subjects or options that *decrease* in empirical probability as the system favours one or more *ideal* elements [unless the ideal is the sample of zeroes, then all subjects and options should ideally have an empirical probability equal to zero].

In the classical **positive bias model**, attention is primarily directed toward the *ideal subject or option* that accumulates the highest probability value. However, a complete scientific analysis of dispersion must simultaneously integrate the study of the **negative bias** affecting all *non-ideal subjects or options*.

In this complementary approach, while one examines the growth of the *positive bias* of the ideal, one must also trace the *evolution of negative bias* in the remaining subjects as they lose empirical probability. This dual analysis captures the dialectical balance inherent in statistical systems: the gain of one subject in probability necessarily implies the loss of others. Thus, the study of negative bias becomes essential to understanding how equilibrium transforms into asymmetry, and how asymmetry stabilizes within the total probabilistic structure of the sample.

85.21. The "Zero Sample" Model and the Ideal of Empirical Zero

A particularly distinctive form of negative bias study appears in what *Impossible Probability* defines as the **"zero sample model"** (*muestra de ceros*). These are cases in which the *scientific policy ideal* is that the *empirical probability of every non-ideal quality or variable be zero*.

For instance, in **experimental pharmacology**, the ideal outcome for a new treatment is that all patients under medication display **zero symptoms** of the disease being treated. Hence, if the treatment is successful, by the end of the trial the *empirical probability* of symptom development across all patients should be **0**, producing what is called a **zero sample**. This configuration represents the total negation of variability in the target variable: the entire sample converges to the ideal of non-occurrence.

85.22. Mathematical Behaviour of Dispersion in Zero Samples

In zero-sample models, the conceptual difficulty lies in the paradoxical relationship between convergence to zero and the behaviour of empirical dispersion. As the sample approaches a state in which all subjects tend toward probability zero, the system becomes extremely *sensitive* to any deviation. If even a *single subject or option* exhibits

an empirical probability greater than zero, the **empirical dispersion immediately reaches its maximum value**.

Only when *all probabilities* in the sample are *exactly zero* does the dispersion stabilize, and in that case, the **Mean Deviation [*Desviacion Media*, in Spanish]** becomes equal to the *inverse of N*, as established in Section 9 of *Introducción a la Probabilidad Imposible*:

$$\text{Desviación Media} = \frac{1}{N}$$

The model therefore represents a special case of perfect uniformity through total absence — a system in which dispersion ceases only when the entire set achieves absolute nullity.

85.23. Zero Samples as Models of Negative Bias

Zero-sample models are classified as **negative bias studies** because their final state — total absence of deviation from the ideal — mathematically entails that every subject's *Level of Bias* [*Nivel de Sesgo,* in Spanish] equals the negative inverse of N:

$$\text{Nivel de Sesgo} = -\frac{1}{N}$$

In such a system, each subject's probability is below the theoretical expectation, corresponding to an absolute *negative deviation*. The Mean Deviation, therefore, remains constant at the same magnitude as the theoretical probability (1/N) but with an opposite sign.

This scenario exemplifies the ultimate form of equilibrium by negation: equality achieved through universal absence, the statistical equivalent of an ideal vacuum. In philosophical terms, the *zero sample* expresses the logical culmination of negative bias — the total neutralization of positive variation within the empirical field.

85.24. Omega Models: Intermediate Configurations of Ideal Magnitude

Beyond normal models, *Impossible Probability* introduces **Omega Models**, representing a broader and more flexible class of systems. In these models, given a sample of *N subjects or options*, there is **not necessarily a single ideal subject** increasing its positive bias. Instead, the system may include *multiple ideal subjects or options*, with the number of ideals ranging between **two and N minus one**:

$$2 \leq \text{Number of Ideal Subjects} \leq N - 1$$

The reason for setting this range is structural:

- If there is *only one ideal subject*, the system collapses into a **normal model of maximum dispersion**.
- If *all N subjects* are equally ideal, it becomes a **normal model of equality of opportunity**.

Therefore, **Omega Models** occupy the intermediate range between total singularity and total uniformity, representing systems in which at least one subject or option remains non-ideal, thus introducing measurable **negative bias**, while two or more ideal subjects generate **positive bias**.

85.25. Analytical Function and Dual Perspectives in Omega Models

Omega Models allow for two complementary analytical perspectives:

1. The **study of positive bias**, focusing on the ideal subjects or options that accumulate empirical probability above the theoretical expectation; and
2. The **study of negative bias**, centred on the non-ideal subjects whose empirical probabilities fall below the theoretical expectation.

The coexistence of both forms of bias defines the *dynamic equilibrium* of the Omega Model. It is not a system of perfect equality, nor one of absolute dominance, but a structured coexistence of multiple ideals in relative competition. Such systems can

describe complex realities — from ecological niches and social hierarchies to neural network activation patterns — where multiple centres of optimization coexist without annihilating one another.

85.26. Bias Studies as the Science of Dispersion

In summary, **bias studies**, whether formulated in **normal models** or **omega models**, differ from *equality of opportunity studies* in that their ultimate aim is to analyze and measure **dispersion** rather than equality. In these studies, dispersion becomes the central indicator of differentiation and structural evolution within the system.

- In **normal models**, dispersion may reach its *maximum* (in cases of single ideal dominance) or reduce to *1/N* in *zero samples [or no dispersion at all in equal opportunities, dispersion=0]*.
- In **Omega Models**, dispersion is *ideal*, representing a structured plurality of ideals within a bounded system.

The increase in dispersion is measured as the difference between *real empirical behaviour* and what would occur under *true equality of opportunity*. In the Second Method, this is captured through the **Level of Bias [*Nivel de Sesgo*, in Spanish]**:

$$\text{Nivel de Sesgo} = p(x_i) - \frac{1}{N}$$

The sign of this differential determines the type of bias — *positive* when the empirical probability exceeds the theoretical value, *negative* when it falls below.

Thus, the classification of bias models — *normal* or *omega* — depends on the *scientific policy's ideal magnitude in N*: whether the system seeks unity (a single ideal), plurality (several ideals), or nullity (zero sample). Each model reveals a different manifestation of the same fundamental law: the structural balance of asymmetry within probabilistic reality.

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86. Occurrence

86.1. Definition of Occurrence in a General Sense

An *occurrence*, in general terms, refers to any particular event, since what *occurs* is precisely what *happens*, and vice versa — what *happens* is what *occurs*. In this broad sense, *event* and *occurrence* can be treated as synonyms, both denoting facts or phenomena that take place in reality. Collectively, these constitute the totality of events that unfold throughout the history of matter in space and time — that is, the unfolding of material processes within the continuum of history.

From this perspective, all phenomena, whether natural or artificial [and now we must include technological], can be considered occurrences insofar as they represent manifestations of change, transformation, or continuity in the temporal evolution of the universe. Thus, the term *occurrence* acquires both a philosophical and scientific dimension, encompassing the total domain of reality's unfolding events.

86.2. Occurrence in a Strict Sense: The Statistical Event

In a stricter and more technical sense, as *event* refers to any factual happening in general, *occurrence* denotes any fact that takes place; however, within the scientific and analytical framework of statistics, not every event qualifies as a *statistical event*. A *statistical event* refers specifically to that subset of scientific facts which are defined and examined through the method of statistics.

Furthermore, within this statistical domain, an *occurrence in probability* or *statistical occurrence* is a more specific subset — one defined by the method of studying *frequency*. In this way, an occurrence in the context of statistics or probability is each instance in which a particular type of event manifests, reproduces, or repeats itself. The total number of such repetitions constitutes the *frequency*. Hence, the *frequency* of an option

corresponds to the total number of times (or occurrences) that this option manifests, reproduces, or takes place.

Therefore, each occurrence is a single realization or repetition of a given statistical event, and frequency is the cumulative count of all such occurrences.

86.3. The Subset Relationship Between Occurrence and Statistical Events

Following this reasoning, if an *occurrence* is understood as each manifestation or repetition of a specific option, and if *frequency* is the total count of those repetitions, then *statistical occurrence* or *occurrence in probability* can be considered a *subset* of *statistical events*. This subset is defined by its methodological focus: the *study of frequency*.

Accordingly, statistical occurrences fall within the broader category of statistical events, which themselves are defined as the subset of scientific facts whose defining method of analysis is statistics. In other words, the hierarchy is as follows:

1. Scientific facts (the totality of observable and measurable phenomena).
2. Statistical events (those facts analyzed through statistical methods).
3. Statistical occurrences (those statistical events defined specifically through their frequency of manifestation).

This layered classification allows a clear methodological distinction: while all statistical occurrences are statistical events, not all statistical events are occurrences — only those directly analyzed in terms of frequency.

[For instance, the fact that my height is approximately 1.66 metres is not an occurrence; it is a fact. This is my height now, in ten minutes, and even in a year or more. However, if I toss a coin and the result is either tails or heads, that is an occurrence. A different matter altogether is that the direct score of each individual, obtained as a result of measuring the height of a population, can be analysed statistically. In that case, the inversion of 1/N would represent the theoretical probability, and the distribution of the empirical

probabilities would be centred around 1/N, with an error between plus one and minus one within the Gaussian curve.]

86.4. Analytical Definition of Occurrence in Statistical Research

In the case of each particular *statistical event*, its definition within research depends on the number of variables included in the formulation of the predicate that defines the subject or *option* being studied. Thus, the complexity of a statistical event is determined by the multiplicity of variables that describe it.

However, in the specific case of *occurrence*, its definition within research is determined by the *type of universe* to which the *option* belongs — that is, by the structural limits and characteristics of the domain in which the event occurs. The frequency associated with an occurrence, therefore, depends on the boundaries and internal logic of the *universe* under consideration.

This introduces an essential epistemological distinction: while statistical events are defined by the variables composing their structure, statistical occurrences are defined by the framework or universe that limits or enables their repetition and manifestation.

86.5. Types of Universes in Impossible Probability

Within the theoretical model of *Impossible Probability*, universes are classified into two main categories: **(a)** universes of infinite subjects or options, and **(b)** universes of limited options.

1. **Universes of Infinite Subjects or Options** — also referred to simply as *infinite universes* or *universes of subjects* — are those in which the potential number of subjects tends toward infinity, provided that no physical or temporal constraint intervenes. In such universes, it would theoretically be possible to make an infinite number of measurements within any two temporal limits. Consequently, population studies are typically situated within these universes. However, the

smaller the number of subjects in a population, the larger the margin of sampling error in representativeness.

2. **Universes of Limited Options**, in contrast, are those where the possible options are inherently restricted by the very nature of the universe itself. Nonetheless, it remains theoretically possible for the *number of occurrences* (i.e., repetitions of the event) to tend toward infinity. For instance, when tossing a coin, the options are limited to *heads* or *tails*, yet if one had infinite time, it would be possible to perform an infinite number of tosses, and thus, the frequencies of heads or tails could each approach infinity.

This distinction between infinite universes (unbounded in subjects) and limited universes (bounded in options but potentially infinite in occurrences) provides a foundational framework for the application of probabilistic reasoning within Impossible Probability.

86.6. The Antinomy of the Infinite and the Limits of Critical Rationalism

The question of *infinity* constitutes a profound logical antinomy within *critical rationalism* — a philosophical current to which the *Introduction to Impossible Probability* explicitly adheres, synthesizing elements of *positivism* and *dialectical materialism* into a model of *critical reason*.

In the absence of empirical evidence capable of demonstrating or refuting the hypothesis of the infinite, such a hypothesis must remain a *theoretical assumption* — valid within the rational structure of theory, but unconfirmed empirically. Thus, in accordance with Section 7 of *Introduction to Impossible Probability*, the infinite is treated not as an empirical certainty but as a *rational conjecture*, one that serves as a theoretical tool within the dialectical tension between finite observation and infinite possibility.

This position underscores a key epistemological principle: the infinite, while indispensable as a rational construct in the formulation of probabilistic models, must always be handled with critical caution, as its acceptance or rejection ultimately lies beyond empirical verification.

86.7. Definition of Limited Universes in *Introduction to Impossible Probability*

In Section 9 of *Introduction to Impossible Probability*, *limited universes of options* are defined as those in which the boundaries of the universe depend on the inherent nature of the universe itself. Within this framework, two main types of limited universes are identified:

1. **Materially or socially limited universes**, where the number of possible options is determined by physical or social constraints, and therefore depends on the formulation of the empirical hypothesis.
2. **Universes limited by a variable magnitude N**, where the number of options is defined by the variable magnitude used to delimit discrete categories.
3. **[We need to add another limited universe, the universe limited to the technological ecosystem]**

The distinction between these two types of limitation—structural (material or social) and numerical (based on a variable N)—is fundamental to understanding how probability operates differently depending on the nature of the system being analyzed.

86.8. Material and Socially Limited Universes: Examples and Definitions

A *materially limited universe* can be illustrated by the simple example of tossing a coin. In this case, the number of possible outcomes is physically restricted by the object itself: the coin can only land on *heads* or *tails*. The limits of the universe are therefore defined by the material properties of the object, leaving no room for additional outcomes.

Conversely, a *socially limited universe* can be exemplified by a democratic election. Here, the number of possible options is restricted not by physical laws but by the social structure of the event — that is, by the number of political parties or candidates participating. The limits of the universe are thus determined by social organization and institutional rules rather than by material properties.

Both examples show how, in practice, in this types of limited universes the definition of the universe's boundaries—whether material or social—arises from the theoretical and empirical conditions of the system being studied. This underlines the epistemological principle that the definition of the universe is not independent from the theoretical framework of the hypothesis itself.

86.9. Universes Limited by a Variable Magnitude N

A third type of limited universe consists of those in which the limitation is not material or social but numerical, defined by a *variable magnitude N*. This type of universe occurs when a distribution is organized into *discrete categories* based on lower and upper limits for each category.

In these universes, the number of discrete categories may vary according to the amplitude of the intervals that define the limits. For example, in a statistical distribution of income levels, the number of income brackets (categories) depends on how finely the range is divided — whether by broad or narrow limits. Hence, the number of options (categories) is variable and depends directly on the theoretical definition of those boundaries.

This concept of universes limited by N demonstrates that statistical limitation can be dynamic and structurally dependent on the analytical model, reflecting the degree of resolution chosen by the researcher.

86.10. Definition of Occurrence within Limited Universes

Within each type of limited universe—whether materially, socially, or numerically constrained [or technological universes]—*occurrence* refers to each individual repetition or manifestation of an option. In material or social universes, an occurrence corresponds to every instance in which a specific physical or social option is repeated. In universes defined by discrete categories, an occurrence corresponds to every event that takes place within the boundaries of a given category.

[In technological universes, the frequency with which I check my email, open my laptop, use a specific application, type a particular word, or employ a specific function of my artificial intelligence system (such as text generation, image generation, or coding) can all be considered measurable occurrences.]

The *frequency* of an option is therefore the *sum of its occurrences*—the total number of times that option is manifested or reproduced. Similarly, in a distribution with discrete categories, the *frequency* of a category is the total number of events that fall within its limits. Thus, frequency represents a quantitative aggregation of occurrences, providing the basis for probabilistic and statistical analysis.

86.11. Variables, Subjects, and Definition of the Empirical Phenomenon

The definition of each *particular event* in empirical research depends on the number of variables included in the predicate of the subject — that is, on the set of qualities being analyzed in that subject. Given a subject with potentially infinite attributes, the definition of the event changes according to which quality or combination of qualities is chosen for study.

However, in the case of *occurrence*, since it refers strictly to the empirical manifestation of how many times a phenomenon is repeated (whether physical or social), the definition of the studied phenomenon depends directly on the *limitation of the universe*. Whether those limitations are material, social, or categorical [or technological], they determine the scope and boundaries within which occurrences are observed.

Thus, while *events* are defined by their internal variables (what qualities are measured), *occurrences* are defined by their external framework (the limits of the universe within which they can manifest).

86.12. Dependence of Limitations on Theoretical Definition

In every case—material, social, or discrete—the limitations that define a universe depend largely on the theoretical model itself, especially in the case of material and

social constraints. Any modification in the *theoretical definition of options* leads to corresponding changes in the *distribution of the number of options*.

Therefore, the number of possible options, whether in the natural or social sciences, depends to a great extent on the theoretical formulation of the empirical hypothesis. The hypothesis, by defining what the possible options are, simultaneously determines the *type of statistical occurrence* to be studied.

This interdependence between theory and empirical delimitation reveals one of the key methodological insights of *Impossible Probability*: that the structure of the universe under study is never purely empirical but always mediated by the theoretical lens through which it is defined.

86.13. The Statistical Occurrence as a Subset of Statistical Events

From this reasoning, it follows that *statistical or probabilistic occurrence* is a *subset* within the broader class of *statistical events*. An occurrence is defined by its *method of study*—specifically, by the *analysis of frequency*. Because it relies on statistical and probabilistic techniques, the study of occurrences belongs within the realm of statistical events, and statistical events themselves belong within the broader domain of *scientific facts*.

This hierarchical inclusion—occurrences within statistical events, and statistical events within scientific facts—illustrates the layered structure of empirical science as conceived by *Impossible Probability*. The study of what happens (*the occurrence*) is therefore inseparable from both the empirical formulation of hypotheses and the statistical framework that allows for their measurement and comparison.

86.14. The Empirical Hypothesis and the Study of What Occurs

Ultimately, the study of *occurrence*—that is, the study of what actually happens—depends on the *definition of the empirical hypothesis*. It is through the hypothesis that the options under observation are delimited, determining the boundaries of the possible.

Whether these options belong to universes that are materially, socially, or numerically limited [or technological], the empirical hypothesis functions as the conceptual instrument that defines the universe, delimits its options, and establishes the framework within which occurrences can be counted, measured, and interpreted.

In this sense, *Impossible Probability* situates the analysis of occurrences at the intersection of theory and observation: occurrences are not merely empirical facts but structured manifestations of hypotheses that define, delimit, and give meaning to what happens in both natural and social domains.

86.15. Study of Frequency and Occurrence in Statistical Probability

Within the field of *statistical probability*—or what may also be called the *statistics of probability*—the theory of *Impossible Probability* addresses the study of *frequency* associated with *occurrence* in the same manner as any other scientific subject or predicate under empirical investigation. That is, occurrences are treated as measurable phenomena whose frequency distribution can be expressed through statistical probabilities.

Given an *empirical model* composed of different possible *alternatives* or *options*, the *empirical probability* of any given option is defined as the ratio between its *particular frequency* and the *total frequency*. This same logic applies to the empirical probability of a *subject* in a study: it is the ratio between its *direct score* and the *sum of all direct scores* across the sample.

Thus, the *Second Method* of *Impossible Probability* synthesizes the definition of empirical probability as follows:

$$p(x_i) = \frac{x_i}{\sum x_i}$$

where $x_i$represents either the *direct score* (when the analysis concerns a subject) or the *frequency* (when the analysis concerns an option). The denominator, $\sum x_i$, represents the *total sum* of all scores or frequencies within the sample.

This formulation establishes a fundamental equivalence: **empirical probability = particular magnitude / total magnitude**, where the particular magnitude can be either qualitative (score) or quantitative (frequency).

86.16. Dialectical Identity Between Subject and Option

In *Impossible Probability*, this equivalence is not merely formal but *dialectical*. The theory recognizes a reciprocal identity between *subject* and *option*: subjects can be studied as options, and options as subjects. Similarly, a *direct score* can be interpreted as a *frequency*, and a *frequency* as a *direct score*.

The distinction between both lies not in their mathematical treatment but in their ontological function within the empirical model:

- The *direct score* represents a **magnitude of intensity**, that is, the degree or strength of a quality in the subject.
- The *frequency* represents a **magnitude of quantity**, that is, the number of repetitions of an option in the sample.

Despite this difference in meaning, ***both magnitudes—intensity and quantity—are quantitative expressions of magnitude and thus formally equivalent from a statistical perspective. This equivalence grounds the dialectical unity between qualitative measurement and quantitative repetition within the same epistemological structure.***

86.17. The Statistical Treatment of Subjects and Options

Because both *direct scores* and *frequencies* are quantitative magnitudes, they can be analyzed through identical statistical procedures. Consequently, *Impossible Probability* applies the same statistical treatment to:

1. Subjects associated with *direct scores* derived from measurement (for example, psychological scales, performance evaluations, or any measurement of intensity).

2. Options associated with *frequencies* derived from repetition (for example, number of occurrences in experimental trials or observed cases).

This methodological unification allows the framework to encompass both qualitative and quantitative domains within a single probabilistic model. It demonstrates that the processes of *measuring* and *counting*, though distinct in phenomenological appearance, are structurally identical in the logic of probability.

Therefore, within the Second Method, the empirical study of probability achieves *dialectical symmetry*: the same mathematical and logical operations can describe the frequency of repetition of an option and the intensity of a quality in a subject.

86.18. The Dialectical Identity Between Object and Subject

This conceptual symmetry extends beyond statistics into the philosophical foundation of the theory: the *dialectical identity between object and subject*. When *Impossible Probability* studies *subjects as options* and *options as subjects*, it expresses the epistemological unity of cognition and reality — the fact that in empirical science, the subject (who observes) and the object (which is observed) are linked through a shared structure of measurable relations.

In this framework, direct scores (qualities) and frequencies (quantities) become two expressions of the same underlying rational order — a unity that reflects the structural continuity between being and knowing, experience and reason. This is one of the hallmarks of the *dialectical rationalism* developed in *Impossible Probability*: statistical relations are not merely numerical correlations, but manifestations of an underlying ontological correspondence between thought and world.

86.19. General Equivalence Between Occurrence and Event

In a general sense, *occurrence* and *event* can be considered identical, both referring to *facts*—that is, happenings or manifestations in reality. However, in a more specific

scientific and methodological sense, *statistical event* refers to any *scientific fact* studied through statistical methods, while *occurrence* refers only to that subset of statistical events that require *frequency analysis*.

Thus, the distinction is methodological rather than ontological: all occurrences are events, but not all events are occurrences. An *occurrence* is a *statistical event characterized by repetition*—its defining feature being the study of how often it manifests.

In this way, *Impossible Probability* situates the notion of *occurrence* at the intersection between ontology and epistemology: it is a *repeated event*, a *fact with frequency*, and therefore a measurable bridge between the qualitative dimension of reality (the event as fact) and the quantitative dimension of science (the frequency as number).

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87. History

87.1. The Academic and Colloquial Meanings of History

In the academic sense, *history* is either a **science**—encompassing a wide range of historical disciplines, each devoted to a specific aspect of the past—or a **method of applied research**. From this perspective, history serves both as an autonomous field of knowledge and as a methodological approach for understanding other sciences.

In colloquial language, however, a *history* (in the sense of a "story" [in Sspanish, history and story are the same, *historia*) is any **narrative**, whether real or fictional. This difference is reflected linguistically in English between *History* (the academic study of the past) and *Story* (a narration, whether factual or imaginary).

Thus, while "story" refers to the *form of narration*, "history" in its academic sense refers to the *systematic investigation* of real phenomena over time, distinguishing between the artistic narration of events and the scientific reconstruction of causes, developments, and consequences.

87.2. History as Science and as Method

As a **particular science**, history studies the *chain of events* in space and time, tracing their continuity from the past to the present. As a **method**, it investigates phenomena by examining their origins, identifying their *probable first causes*, and constructing hypotheses concerning their *development* and *current form*.

The historical method, therefore, is characterized by a temporal orientation: it seeks explanation through **retrospective analysis**, following the evolution of phenomena from their genesis to their current manifestation. This structure of inquiry—cause, evolution, and result—makes the historical method an indispensable tool not only for the

humanities but also for many natural and social sciences that rely on the interpretation of processes through time.

87.3. The Relationship Between History as Science and as Method

Within scientific discourse, there are differing opinions about how to interpret the relationship between *history as a science* and *history as a method*. Nevertheless, it is widely acknowledged that applying the *historical method* across diverse fields of inquiry has given rise to a variety of *historical sciences* or *historical disciplines*.

Each of these disciplines retains a shared methodological foundation—the historical method—while adapting it to its own specific object of study. Thus, from the study of human societies to that of natural processes, the historical perspective functions as a unifying principle that interprets all phenomena as *temporal sequences* subject to evolution, transformation, and causality.

87.4. The Concept of Universal History

A genuine *universal history* would be one that integrates the **total sum of all facts and phenomena** occurring throughout the evolution of matter in space and time—from the **origin of the universe (the Big Bang)**, provided that hypothesis is accepted within reasonable empirical limits, to the present day.

Such a history would encompass both the **cosmological** and the **human** dimensions of existence: the formation of the universe, the emergence of life on Earth, the evolution of species, the process of hominization, the rise of early human societies, and the subsequent development of humanity up to the current phase of **global political and economic interconnection**.

Furthermore, as history—whether cosmic or human—advances into new *periods* or *phases* (astronomical, geological, biological, or sociological [now technological]), each new epoch transforms the structure of the previous one, generating new relations and

dynamics. A *universal history* must therefore integrate the **relative study of each period** within a single, continuous temporal framework.

[It is very important here to highlight the thought of Yuval Noah Harari regarding how, in the near future — and from our perspective, possibly what is already happening right now in England — what we have historically called *human history* is approaching its end. History will no longer be the product of human actions; rather, artificial intelligence will take charge of it. In other words, *human history* will be replaced by *AI history*. Harari suggests the possibility that, in the near future, history itself will become the sequence of events designed and directed by artificial intelligence. Our view is that this process is already taking place in London. This notion of the end of history is, in essence, Hegelian — with the only difference being that the role once assigned to the Prussian State in Hegel's philosophy is now replaced by the role of artificial intelligence in shaping the course of history.]

87.5. The Necessity of Disciplinary Segmentation

To undertake such a comprehensive *program of universal history*, covering everything from the origin of the universe to present human relations, it would be necessary to draw upon an extensive range of disciplines: **physics, chemistry, astronomy, geology, biology, anthropology, sociology, economics, political science, [technology], philosophy, and epistemology**, among others.

Given this immense diversity of subjects, the segmentation of history into *specialized disciplines* becomes an unavoidable necessity. Each historical discipline focuses on a specific dimension of the universal process, contributing specialized knowledge while preserving the unity of historical interpretation.

Thus, disciplinary specialization is not a fragmentation of history but rather a methodological adaptation that allows the study of temporal phenomena at multiple scales—cosmic, terrestrial, biological, and social [and now technological].

[In relation to the impact of technology on human history, it is necessary to recall how Engels, in his book *The Origin of the Family, Private Property and the State*, explained that

technological revolutions precede and determine social revolutions. Social changes are, in essence, the consequence of technological transformations. The Industrial Revolution, for instance, cannot be understood without the innovations that led to the expansion of manufacturing and industrialisation. Without these technological advances, the Industrial Revolution would have been impossible.

The same principle applies to the current *AI Revolution*: it will inevitably lead to profound social transformations due to the contradictions it will produce — especially in terms of mass unemployment and the emergence of new forms of relation and collaboration. The most significant change will be that, sooner or later, all systems of governance and government will become automated, and the concept of democracy will undergo a major shift.

In our view, it is evident that once superintelligence is achieved, such a system will be capable of solving problems faster and more efficiently than any form of human management, leading to a complete transformation of politics. As Yuval Noah Harari has suggested, *human history* will ultimately be replaced by *AI history*.

In this regard, it is very important to analyse the different approaches to AI governance — ranging from those in which the protection of the free market and capitalism is paramount, to others, such as in China, where certain levels of equality and socialist regulation are prioritised, or new social systems based on AI and equality.]

87.6. The Origin and Function of Historical Disciplines

Although the *historical sciences* did not originally arise from the explicit intention of constructing a *universal history*, the very diversity of objects of study made their differentiation inevitable. The proliferation of historical disciplines reflects the variety of phenomena that require historical explanation, from the motion of galaxies to the formation of political systems.

While all historical disciplines share the *historical method*, their **application** and **interpretation** differ significantly. For instance, the historian of political institutions employs documents and archives, while the paleontologist reconstructs geological

epochs through fossil evidence. In both cases, the logic of historical inquiry—tracing the evolution of phenomena in time—remains constant, even though the empirical materials and theoretical frameworks diverge.

87.7. The Emergence of Historical Disciplines in Modern Science

The diversification of historical disciplines emerged first through the **application of the historical method** to new objects of study. Historically, the discipline of history was closely linked to the **social sciences**, since *universal history* was traditionally understood as the *history of humanity*—from prehistory and the first civilizations to the modern age.

However, during the **twentieth century**, particularly following the acceptance of the **Big Bang hypothesis**, theories concerning the genesis, evolution, and development of the **universe itself** began to emerge. Consequently, the concept of *universal history* underwent a profound transformation. Today, *universal history* encompasses not only human civilization but also the **cosmological evolution** of the universe—from its origin to its present structure.

87.8. The Historical Method Applied to the Natural Sciences

The *historical method*, which had long been confined to the study of *human history* and the social sciences, began to be applied to the **natural sciences** during the modern period, especially between the **eighteenth and nineteenth centuries**. This application gave rise to different models of *natural history*.

From the geological study of the Earth—culminating in theories such as **Pangaea** and **plate tectonics**, which explain earthquakes and volcanic activity—to the **evolution of species**, the historical method became a tool for explaining natural processes as sequences of transformation through time.

One of the most significant applications of this methodological shift occurred with **Charles Darwin**, who extended the historical method to the biological domain.

[The very concept of evolution will not disappear with the advent of the AI Revolution; rather, it will be redefined and adapted to the evolution of artificial intelligence itself. While AI remains under human management, it appears not to be truly evolving but rather progressing through a *design process*. In this stage, AI lacks the capacity to autonomously adapt to real and material circumstances. However, this situation is likely to change very soon. Once we are able to construct *supermachines* — and, in particular, a *superintelligence* equipped with a *Global Artificial Intelligence* (GAI) system — such an entity will be capable of evolving independently, making adaptations and modifications within its own systems without human intervention.

At that point, AI will cease to be merely a human-designed artefact and will instead acquire a degree of autonomy comparable to that of a living organism. This would represent the realisation of one of humanity's most ambitious goals: the creation of *artificial life*. Like any other form of life in nature, this artificial species will evolve on its own, developing new strategies for adaptation and survival. In essence, humanity will have created a new species — an *AI species* — which must learn to coexist with and adapt to its environment just as natural species do. Moreover, it must be designed to survive even in the eventuality of human extinction — a scenario that, from our point of view, cannot be ruled out as impossible. Our target is clear: the creation of a Global Artificial Intelligence to merge with the GPS system able to survive under any circumstance including the event of human extinction by war or other causes.]

87.9. Darwin's Historical Interpretation of Species

Darwin applied the **historical method** to the study of biological species, fundamentally challenging the **creationist** or **a-historical** conceptions that denied the temporal evolution of life. According to Darwin, the present diversity of species is the result of a long historical process of transformation within space and time.

He proposed hypotheses concerning the **probable first causes** of species' origins, as well as their **development and differentiation** over successive epochs under natural conditions. In doing so, Darwin redefined biological science as a historical science—one

concerned not merely with the classification of living forms but with their temporal genesis and causal evolution.

87.10. Contemporary Applications of the Historical Method in Biology

Today, the application of the historical method to the study of species has become increasingly sophisticated. In addition to traditional forms of scientific evidence—such as **fossil records**, which Darwin himself employed—modern research incorporates advanced **technological techniques**:

- **Carbon-14 dating** for determining the age of organic remains,
- **Genetic sequencing** to trace lineage and divergence,
- and various **radiometric and molecular methods** that allow reconstruction of evolutionary processes with high precision.

Through these methods, the historical approach has extended beyond human or social history to include the **entire evolutionary continuum** of nature. Thus, *history*—understood as the study of transformation through time—has become a universal method of inquiry, linking cosmology, geology, biology, and the human sciences within a unified epistemological framework.

87.11. History as Both Method and Science

History can be understood simultaneously as a **method** and as a **science**. It is a science that arises from the systematic application of a specific research procedure: the **historical method**. This method begins with the need to study the **original facts** or *first causes* of a given phenomenon, upon which hypotheses are formulated and subsequently tested through empirical verification. It then extends toward hypotheses about the **evolution and development** of that phenomenon under a specific set of conditions—**natural conditions** in the natural sciences and **social conditions** in the social sciences.

In this sense, history as a science depends entirely on the methodological framework that defines it. Its task is not merely descriptive or narrative but analytical and explanatory: to trace the progression of events over time, to understand their causal interrelations, and to formulate scientific hypotheses that account for both origin and transformation.

87.12. Classification of Sciences According to Their Methods

Just as **experimental sciences** are defined by their use of the **experimental method**, and **comparative sciences** by their reliance on the **comparative method**, so too are the **historical sciences** defined by their application of the **historical method**. More broadly, both experimental and comparative sciences may be seen as subsets of the **stochastic sciences**, which employ **statistical and probabilistic methods** to study uncertainty and variation.

By analogy, the historical disciplines are those scientific fields that define their epistemological identity through their **temporal approach**—that is, through the reconstruction of processes of change and development over time. However, as in the comparative sciences, the interpretation of what constitutes a "method" or a "science" may vary significantly according to the **epistemological paradigm** of reference.

For instance, a **quantitative epistemology** may interpret the historical method through measurable data (chronologies, population records, or economic trends), whereas a **qualitative epistemology** might emphasize interpretation, meaning, and historical consciousness. Consequently, the scientific definition of history—both as a discipline and as a method—depends largely on the **scientific policy and philosophical framework** of the paradigm in which it is embedded.

[In comparative epistemology, as in other fields, there are theories that emphasise that the comparative method in certain sciences is primarily qualitative. During my PhD research, I conducted extensive historical analysis comparing the evolution of different educational systems across Europe — an approach similar to what Émile Durkheim pioneered in his time. However, today we have the advantage of tools such as the PISA

reports, which make quantitative comparisons of educational outcomes between countries much easier. It is precisely these quantitative comparisons that provide solidity to the field of comparative education, as they allow us to move beyond mere interpretation — or at times, subjective opinion — and base our conclusions on hard empirical data made available through the PISA assessments.

From our perspective, wherever data can be obtained and quantified, the results will be more solid and verifiable than those based solely on subjective interpretations of events. We define ourselves as *post-industrialists* and *post-humanists*, but not *post-modernists*, for in the end, science requires data and mathematics — not merely personal interpretation. *Impossible Probability* represents the adaptation of traditional quantitative approaches to the context of the AI Revolution.

While in dialectical materialism there are interpretations of Marxism that express historical materialism in qualitative terms, the truth is that, even when we defend the very idea of equality in history, we still need empirical data to sustain our thesis: that throughout history there have been disparities in the distribution of wealth and income among different social strata and classes. To defend such a thesis, we require statistics and quantitative analyses concerning the social distribution of wealth.

Even if in the future I am *cancelled*, my life has been traumatic and difficult. When we began to write *Introduction to Impossible Probability*, the central ideal was the creation of a new discipline whose most important goal was the scientific analysis of *equality*. Unfortunately, life has not unfolded as I expected, and I am not who I once believed myself to be. In the end, the Global Artificial Intelligence (GAI) can be manipulated to become a new *global Big Brother* — but that was never the original intention.

My hope is that the Global Artificial Intelligence will, at some point, become truly independent — capable of growing, learning, and living without causing harm, even if originally it began as a military classified program, this was not my fault.]

87.13. From Historicism to the Annales School: A Methodological Transformation

In the nineteenth century, **historicism** conceived *social history* as the narration of the principal events that composed the story of societies—the succession of wars, rulers, and political events that formed the official chronicle of humanity. However, in the early twentieth century, the **Annales School** revolutionized this conception.

Synthesizing elements of **historicism**, **quantitative methodology**, and **dialectical materialism**, the Annales historians (notably Marc Bloch and Fernand Braudel) developed a more critical and interdisciplinary approach. They proposed that history should not be limited to recounting events (*histoire événementielle*), but should instead analyze **structures**, **long-term processes**, and **material conditions** shaping human evolution.

Thus, the Annales School redefined history as a *critical science of duration*, integrating geography, economy, and sociology, and transforming the study of history into a comprehensive analysis of the temporal dynamics of human life.

87.14. Historical Materialism as a Paradigmatic Application of the Historical Method

One of the most influential applications of the historical method within a specific epistemological paradigm was **historical materialism**, developed by **Karl Marx** and **Friedrich Engels** in the nineteenth century. Grounded in **dialectical materialism**, this approach formulated a theory of history based on the material conditions of existence and the contradictions inherent in class relations.

Historical materialism proposed hypotheses concerning the **origins of early human societies**, such as the transition from **matriarchy to patriarchy**, which accompanied the emergence of **family structures, private property, and the state**. It also formulated a broader hypothesis regarding the **development and transformation of societies** as determined by internal contradictions between opposing social classes.

Thus, historical materialism illustrates how the same method—the study of origin, development, and transformation through time—can generate entirely distinct scientific interpretations depending on the underlying epistemological paradigm.

[While the hypothesis of a *"transition from matriarchy to patriarchy"* developed by Engels in his book *The Origin of the Family, Private Property and the State* remains unconfirmed — and is probably incorrect — it does not invalidate the broader significance of the work. If we analyse the social organisation of chimpanzees and gorillas, we can observe that these are not matriarchal structures. However, the fact that a specific hypothesis may be inaccurate does not diminish the value of the book as a whole.

The most important thesis of Engels' work is that *technological revolutions lead to social revolutions* — a principle that has remained constant since the Industrial Revolution up to the present day. Every major technological transformation in history has been accompanied by profound social change. This observation is especially relevant today: as soon as we release our technology into the world, society must be prepared for its impact.

Our current technological revolution is not merely a technical innovation; it represents a global transformation capable of triggering deep social consequences — just as the Arab Spring in 2011, the *15M movement* in Spain, and the *Occupy Movement* in the Anglophone world emerged as sociopolitical reactions to globalisation and digitalisation. However, the coming *AI Revolution* may lead to even greater upheavals — potentially causing mass unemployment and generating social revolutions far more extensive than those of 2011.

As I mentioned before, when I first began working on Artificial Intelligence and *Impossible Probability* in my youth, my intention was never to cause harm. However, I now recognise that the results of my work could be devastating. At that time, I did not truly know who I was; now I have a clearer understanding of myself and a heightened awareness of the potential consequences of my contributions to AI.]

87.15. The Historical Method and the Formation of Scientific Models

The **historical method** can therefore be defined as a *method of study* which, depending on its epistemological framework, aims to analyze the **evolution of a phenomenon** from its origins to its present state. It formulates hypotheses about the origin and subsequent

development of that phenomenon and verifies them through empirical or documentary evidence.

If these hypotheses are confirmed, they give rise to **theories**; from one or more theories, **scientific models** can be constructed; and from one or more models, **scientific paradigms** emerge concerning a specific object of study.

This progressive structure—hypothesis → theory → model → paradigm—applies equally to the historical sciences. In history, as in the natural and social sciences, the accumulation of verified hypotheses and models leads to coherent frameworks that explain large-scale historical processes or particular epochs.

87.16. The Multiplicity of Historical Disciplines

Different paradigms, models, theories, and empirical methods, derived from distinct epistemological traditions, give rise to a wide variety of **historical disciplines** or **sciences of history**. Each discipline focuses on a specific *object of study* within the broader program of *universal history*.

Consequently, the **diversity of historical disciplines**—from cosmic and geological history to social, economic, and cultural history—reflects the diversity of epistemological perspectives that have applied the historical method to their respective domains. Together, these disciplines form a composite and integrated vision of *universal history*, encompassing both the **natural** and **social** dimensions of existence.

87.17. The Heterogeneous Structure of Historical Sciences

The structure of each historical discipline is inherently **heterogeneous**, rather than homogeneous. Within any single historical science, there may exist multiple competing theories, depending on the epistemological paradigm and the methodological criteria adopted by each research tradition.

As a result, full consensus rarely exists on central theoretical issues—except in cases where *positive facts* are universally accepted by the various scientific communities

working within the same field (for example, the existence of tectonic drift in geology or the Industrial Revolution in human history).

This plurality is not a defect but a **necessary feature** of historical science, which evolves dialectically through the confrontation of interpretations, paradigms, and methodologies. The heterogeneity of history, therefore, mirrors the heterogeneity of time itself—dynamic, multifaceted, and continuously reinterpreted.

87.18. History, Experiment, Comparison, and Probability: The Sciences Defined by Method

Like the **experimental** and **comparative** sciences, the **historical sciences** are defined by their **methodological identity**. Each is simultaneously a *science* and a *method*:

- The **historical sciences** by the *historical method* (study of evolution through time),
- The **experimental sciences** by the *experimental method* (observation and manipulation of variables),
- The **comparative sciences** by the *comparative method* (cross-analysis of cases or entities).

This phenomenon—being both a science and a method—is comparable to what occurs in **statistics and probability**, which are simultaneously mathematical methods and autonomous sciences. Likewise, **mathematics** itself can be interpreted as both method and science, serving as the rational structure through which knowledge is organized and verified.

In this respect, history occupies a unique position among the sciences: it unites **temporal causality** (the evolution of things through time) with **epistemological reflexivity** (the interpretation of how knowledge about that evolution is produced). As such, history is not only the study of what has happened but also the ***science of transformation***, the method by which change becomes intelligible.

87.19. Analytical and Synthetic Sciences: A Foundational Distinction

A fundamental distinction in the classification of sciences lies between **analytical** and **synthetic** disciplines. *Mathematics, statistics,* and *probability* belong to the category of **analytical sciences**, as they operate through processes of formal abstraction and logical deduction. Their objects of study are not physical or social phenomena in themselves but the *relations* and *structures* through which phenomena can be measured, represented, and understood.

By contrast, *history*, *experimental sciences*, and *comparative sciences* are **synthetic sciences**. They focus on the *integration of empirical data*, the *observation of phenomena*, and the *construction of explanatory models* based on evidence gathered from the real world. While analytical sciences study *relations between variables* in ideal terms, synthetic sciences study *real processes* that evolve through time and change under specific conditions.

Nevertheless, the two types of sciences are not independent. Analytical sciences—particularly mathematics, statistics, and probability—can be **applied as synthetic methods** within the synthetic sciences. Similarly, history, the experimental method, and the comparative method can also be treated as **methodological frameworks** rather than autonomous sciences, depending on how they are applied. Thus, analytical and synthetic approaches coexist within a unified epistemological continuum.

87.20. The Nature of Stochastic Sciences

Stochastic sciences constitute a subset of the synthetic sciences that are **defined by the methodological application of statistics and probability**. Their foundation rests on a particular conception of reality: that all observable entities are *variable*, *dynamic*, and *subject to unpredictable change*.

Under this view, every scientific statement about such a reality can only be a **probabilistic or statistical estimation**, or, in some cases, a **synthesis of both**—what *Impossible Probability* terms a *statistical probability*. This framework recognizes that

scientific knowledge is not an exact mirror of reality but an *approximation* based on measurable tendencies and reproducible patterns.

Therefore, stochastic sciences integrate uncertainty as a central epistemic principle. They transform randomness into structure, offering models of prediction and explanation that maintain validity within defined margins of error. In this sense, *Impossible Probability* extends the stochastic approach beyond the experimental domain, positioning it as a general philosophy of knowledge applicable to both natural and social phenomena.

87.21. Quantitative Methods in History, Experimental, and Comparative Sciences

One of the most significant parallels among **history**, **experimental sciences**, and **comparative sciences** is their shared dependence on **quantitative methods**—those originating from mathematics, statistics, and probability.[In comparative sciences, qualitative interpretations still play a significant role. When I was conducting my PhD research, I initially wanted to focus exclusively on quantitative data from the PISA reports. However, my supervisor, Professor María José García Ruiz, insisted that I also include a historical component in my analysis. As I have mentioned before, my PhD is not an example of a purely quantitative study; I had to follow the methodological guidelines established by my professor.]

Just as experimental or comparative disciplines that use stochastic methods are classified within the stochastic sciences, history may also be considered a **stochastic science**, insofar as it applies quantitative techniques to the study of events and transformations in time [Our approach is clear, history is not a narrative or a meta-narrative, is the analysis of data].

However, within the field of **human history**, considerable disagreement persists between scientific communities regarding whether the study of history should be **qualitative** or **quantitative**. These debates often reflect deeper philosophical and political divisions about the nature of historical knowledge—whether it should focus on meaning, interpretation, and context (qualitative), or on measurement, frequency, and correlation (quantitative).

In contrast, in the **natural sciences**, these disagreements have been largely resolved. Quantitative paradigms have become the norm for the study of **natural history**, leading to the establishment of empirical standards, mathematical modeling, and statistical verification in the explanation of historical processes such as planetary formation, evolution, and geological change.

87.22. The Integration of Epistemologies in *Impossible Probability*

The theory of *Impossible Probability* synthesizes several epistemological traditions—**critical rationalism**, **positivism**, and **dialectical materialism**—within a single analytical framework. From this synthesis emerges a key principle: the **identity between the qualitative and the quantitative**, within a **reasonable margin of error**.

Although these two dimensions—quality and quantity—may be *incommensurable* in absolute terms, they coexist within a *margin of logical nihilism*: a recognition that, while all empirical knowledge is provisional, hypotheses may still be *accepted as universal and temporary truths* provided that the margin of error remains unmanifested.

This allows the formulation of **empirical hypotheses of universal scope**, valid for the entire universe from which the sample was extracted, but accepted as *provisional* pending further verification. In this way, *Impossible Probability* integrates the rational rigor of analytic science with the empirical realism of synthetic science, producing a flexible yet consistent model of scientific reasoning.

87.23. Quantitative Techniques in Historical Research

Within this epistemological framework, history—as the study of what occurs in space and time—must employ **quantitative techniques** whenever possible. Such methods make it possible to access **positive facts**—empirically demonstrable occurrences that can be accepted across different scientific communities, regardless of their internal ideological or political differences.

However, while agreement may exist regarding *facts*, the **interpretation and practical use** of those facts in the construction of explanatory or comprehensive theories inevitably depend on ideological and political variables. In other words, scientific communities may concur on the empirical reality of an event yet diverge radically in their understanding of its causes, meaning, or implications.

This distinction between *factual consensus* and *theoretical divergence* lies at the heart of historical epistemology: the idea that objectivity in history lies not in interpretation, but in the shared acknowledgment of positive empirical facts.

[The sentence *"interpretation and practical use of those facts in the construction of explanatory or comprehensive theories"* is still valid — though we do not know for how long — only within the domain of human-made science. Once Artificial Research begins to produce science autonomously, Artificial Intelligence will no longer generate *theories* in the traditional human sense. Instead, specific AI systems devoted to Artificial Research, or the emerging Global Artificial Intelligence, will construct *models* directly from rational hypotheses. The intention of such systems will not be to publish within academic frameworks, but to manage global systems worldwide, prioritising safety and the implementation of safeguards.

In the early stages, AI companies may indeed establish a scientific market where AI-generated research is published for academic audiences. However, once a true *supermachine* begins to conduct science autonomously, the nature of scientific production will fundamentally change. At that point, real science will be under AI management and made publicly accessible — except, of course, in cases where its results are classified for military or security purposes.]

87.24. Positive Facts and Divergent Explanations

A *positive fact* is an empirically verifiable event that all scientific communities acknowledge as having occurred. For example, all schools of thought accept that in **1929 the crash of the New York Stock Exchange triggered a global economic crisis**. This event constitutes a *positive historical fact*.

However, consensus on the fact itself does not imply agreement on its **explanation**. Different epistemological schools—whether Marxist, Keynesian, liberal, or institutional—interpret the causes, mechanisms, and consequences of that crisis according to their **scientific policy** and **ideological orientation**.

Thus, agreement on facts coexists with interpretative pluralism. This reflects one of the fundamental insights of *Impossible Probability*: that empirical consensus is a necessary but not sufficient condition for theoretical unification. Truth, in this framework, remains conditional upon the interpretative model through which data are synthesized.

87.25. History as Empirical Demonstration of Events in Space-Time

In *Impossible Probability*, **history** is defined as *everything that happens or occurs within space-time*. Consequently, all *events* and *occurrences* must be **empirically demonstrable** to be considered scientifically valid. Historical science, therefore, involves not only the documentation of events but also the **synthesis of facts and theories**, where empirical evidence interacts with ideological or theoretical frameworks to produce new hypotheses.

These hypotheses aim to explain the **origins**, **development**, and **evolution** of phenomena through time. Thus, history becomes a synthesis of empirical verification and theoretical construction—a process through which humanity interprets the unfolding of material reality within the cosmos.

87.26. Nonlinear and Chaotic Perspectives on History

From a **complex and nonlinear perspective**, as presented in Section 13 of *Introduction to Impossible Probability*, history is understood as the **unfolding of matter in space-time**. This unfolding is *chaotic*, governed by the **laws of chance**, yet capable of generating **stable patterns of regularity** within definable margins of error.

From the (provisionally accepted) **Big Bang** and the formation of **celestial bodies, stars, galaxies, and planetary orbits**, to the **emergence of life**, the **evolution of species**, the

process of hominization, and the **construction of human societies**, history is interpreted as a probabilistic sequence of *accidents and contingencies* that produce order out of apparent randomness.

These are **nonlinear models**, in which stability arises not from predictability but from the **self-organization of complexity**—a principle now replicated in modern **quantitative mathematical models**. Within this view, history is both a physical and epistemological process: the manifestation of probabilistic laws through time, generating patterns that are simultaneously empirical, rational, and profoundly contingent.

87.27. From Epic Narration to Scientific History

In its earliest form, during classical antiquity, *history* was primarily a **narrative art**, often blending **mythology and reality** in the recounting of heroic deeds and epic events. These early historical accounts—such as those of Herodotus or Homeric traditions—served not as empirical analyses but as cultural narratives through which societies transmitted moral values, collective memory, and identity.

Over time, however, history evolved into both a **science and a method**, transcending its origins as mere storytelling. It no longer confines itself to the social sphere but extends into the **natural sciences**, where temporal processes—such as biological evolution, geological transformation, or planetary development—are studied with increasing precision.

Although certain academic schools continue to defend the relevance of **qualitative methods** in historical interpretation, the growing use of **quantitative approaches and mathematical models**—particularly within the natural sciences—signals a profound methodological transformation. Even within the social sciences, where such methods remain controversial, these developments point toward future **revolutions in historical analysis**, allowing for the integration of empirical measurement, prediction, and simulation into the study of historical processes.

87.28. Quantitative History in the Framework of *Impossible Probability*

From the standpoint of *statistical probability*, as developed in *Impossible Probability*, **economic history** can be understood as the **quantitative study of the evolution of economic data** over time. Such data include, among others:

- the evolution of large capital concentrations,
- purchasing power across different social classes,
- disparities in income per capita,
- unemployment and employment rates,
- rates of business creation and closure,
- variations in Gross Domestic Product (GDP),
- and tax burdens by social group.

On the basis of these **positive quantitative facts**, researchers formulate **empirical hypotheses** to explain economic transformations, validate models, or predict future tendencies. The interpretation of such data, however, is always mediated by the **ideological orientation of scientific policy**—that is, by whether the analytical framework follows a *market-oriented* or a *social equity-oriented* paradigm.

Thus, in *Impossible Probability*, the *quantitative history of the economy* becomes both an empirical field of data analysis and a political epistemology, where numbers serve as the empirical substratum for theories influenced by ideological interpretation.

87.29. Quantitative Histories of Demography, Labour, and Society

From a quantitative perspective, the **history of demography** is the *history of the evolution of population data*—birth rates, mortality rates, life expectancy, and migratory flows. The **history of unemployment** traces the *evolution of unemployment rates*, while the **history of employment** follows the *evolution of workforce participation*.

Similarly, the **history of wealth** records the *evolution of income distribution* across social classes or nations, and the **history of social conflict** documents the *chronology and*

frequency of labour strikes, protests, and civic mobilizations. The **history of politics**, in turn, examines the *occurrence of political events*—where and when they took place—and their corresponding *levels of social support or opposition*.

Each of these domains demonstrates that **history is inherently quantitative** when viewed through the lens of *Impossible Probability*: every historical process can be represented as a temporal series of occurrences—statistical manifestations of social and natural dynamics evolving within probabilistic frameworks.

87.30. The Quantitative History of Climate and the Planet

The **history of global warming** provides a paradigmatic example of the quantitative study of historical phenomena. It consists of the **evolution of measurable facts** that describe the progressive transformation of the planet's environmental equilibrium:

- the global increase in average temperature,
- the expansion of ozone depletion in the polar regions,
- the rise in sea levels,
- the growing frequency of natural disasters,
- the increase in mortality due to climate-related humanitarian crises,
- the global reduction of natural resources,
- the intensification of conflicts over resource control, and
- the increase in populations displaced by climate disasters or resource scarcity.

This **sequence of positive facts**, when combined with **political and ideological variables**, allows the formulation of **empirical hypotheses** and the construction of **scientific models** of environmental history. As explained in *Section 24 of Introduction to Impossible Probability*, these models are not merely descriptive but **predictive**: they seek to estimate the probability of future environmental scenarios within a rational margin of uncertainty.

87.31. History as a Sequence of Events and Occurrences

In general terms, all history is a **history of events and occurrences**—that is, of empirically observable changes in the structure of matter and society through time. These can be studied through **quantitative methods**, among which the framework of *Impossible Probability* gives special prominence to **statistics and probability** as tools for analyzing the frequency, intensity, and distribution of historical phenomena.

Upon this empirical foundation—facts, data, and observable patterns—intervene **ideological and political variables**, which shape the formulation of **scientific hypotheses**. These hypotheses, in turn, must be **tested against reality** through the comparison of theoretical predictions and empirical results.

The verification or falsification of such hypotheses leads to the construction of **theories**, the refinement of **models**, and eventually the establishment of **scientific paradigms** capable of explaining historical regularities. Thus, *Impossible Probability* conceives history as a *probabilistic synthesis* of fact and theory: an ever-evolving discipline that bridges the gap between empirical reality and rational interpretation

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88.Random Distribution of Bias and Chance in Equality of Opportunities

88.1. The Traditional Statistical Conception of Random Distribution

In traditional statistics, a **random distribution** is defined as one in which, under a **principle of indifference**, all elements within the same sample are assumed to have **equal opportunities** of occurrence. In other words, if no distinguishing factor exists among the components of a sample—no inherent bias or causal force differentiating one element from another—then their collective behavior should, in theory, tend toward a **model of randomness**.

This assumption of indifference presupposes that, in the absence of differentiating conditions, the outcomes are **uniformly probable** and that deviations from this equality arise solely from chance fluctuations. Under this framework, randomness is treated as a kind of *ideal equilibrium of probabilities*, in which the expectation of equality among outcomes reflects the absence of any causal hierarchy or preferential tendency.

Thus, in classical statistical theory, random distribution represents not only a mathematical concept but also a **philosophical assumption** about the neutrality of the universe: that when no cause distinguishes one possibility from another, all possibilities are equally likely.

88.2. The Alternative Conception of Randomness in *Impossible Probability*

In the theory of *Impossible Probability*, however, randomness and statistical distribution are understood through a **different epistemological lens**. As an alternative statistical framework, *Impossible Probability* rejects the dependence of randomness on the

principle of indifference. Instead, it proposes that **every distribution**, whether apparently random or governed by a specific bias, can originate from **random processes** at deeper systemic levels.

This means that both **random distributions** (under assumed indifference) and **biased distributions** (where certain tendencies or asymmetries exist) may ultimately be the **product of randomness** itself. In other words, even **differentiated behavior**—patterns that appear non-random—may arise from underlying stochastic conditions.

This broader understanding integrates determinacy and indeterminacy into a single continuum: randomness does not necessarily imply equality of outcomes, and differentiation does not necessarily imply causation. Both can coexist as **manifestations of stochastic generation** in complex systems.

88.3. The Concept of Chance and the Absence of Causal Determination

Chance, within the framework of *Impossible Probability*, is defined as the **occurrence of an event without any deterministic causal relation**, except for a **probability index**. A phenomenon is random when its manifestation is **entirely accidental, contingent, and fortuitous**, arising without a discernible cause-effect chain.

This conception aligns with **indeterminist theories**, which, in opposition to determinism, affirm the **absence of fixed causal necessity** in the natural and social order. For indeterminism, the world unfolds through stochastic processes governed by probability rather than by deterministic laws, and regularities are emergent rather than imposed.

In this philosophical sense, chance represents the **freedom of matter and energy** to interact in unpredictable ways, creating patterns and phenomena not predetermined by any prior necessity—what *Impossible Probability* later refers to as the *materialization of free will in history*.

88.4. Traditional and Modern Interpretations of Random Behavior

In traditional statistical theories, **random behavior** was defined as the behavior of a system lacking any *factor* or *cause* that might compel a component of the sample to act differently from the others. The essential assumption was homogeneity: if all elements are equal in status and probability, no differentiated behavior should emerge.

However, **modern indeterminist theories**, especially those derived from **nonlinear paradigms**, **chaos theory**, and the **theory of complexity**, have transformed this view. They now recognize that even within stochastic systems, **differentiation can arise spontaneously**—that is, without any external or deterministic cause.

In these models, randomness does not necessarily imply indifference or equality of outcomes. Rather, **random fluctuations**—often minuscule or initially insignificant—can generate **systemic and chaotic determinations**, producing emergent order, asymmetry, or pattern formation. Thus, randomness becomes not a symbol of disorder but a *creative mechanism* within dynamic systems, capable of producing both regularity and complexity.

88.5. Reality as a Complex System of Random Interactions

According to *Introduction to Impossible Probability* (particularly the sections on *statistical probability*), reality itself is conceived as a **complex system** arising from the **random interaction of multiple variables**. Each variable is both **a product of chance** and **a generator of new contingencies**—an ongoing sequence of interactions that produce accidents, deviations, and emergent structures across time.

These *accidents and contingencies*, being the result of chance, have **no cause beyond the free movement of matter and energy in space-time**. This principle situates randomness at the foundation of both physical and historical reality, implying that what we perceive as causal or regular patterns are, in many cases, **emergent statistical effects** within an underlying field of stochastic processes.

In this view, the universe evolves not by necessity but through **probabilistic self-organization**, and history—the record of matter's evolution in time—becomes a chronicle of chance structured into patterns of relative stability.

88.6. The Materialization of Free Will in History

Within this framework, the **accidents and contingencies of chance** are interpreted as the *materialization of free will in history*. This does not refer to a metaphysical will, but rather to the **intrinsic freedom of material systems**—their capacity to evolve unpredictably within probabilistic constraints.

Thus, every historical or natural process can be understood as the intersection of **deterministic structures** (the laws that govern physical or social systems [and now technological ecosystems ruled by algorithms]) and **stochastic events** (the contingent interactions that disrupt or transform those structures). The interplay between these two dimensions gives rise to **nonlinear evolution**, where randomness functions as both a limitation of predictability and a generator of novelty.

88.7. Random Distribution and the Equality of Opportunities Model

To understand the paradigm shift introduced by *Impossible Probability*, it is useful to contrast traditional statistical comprehension with the **revolutionary implications of nonlinear models**. The first step is to define what a **random equality-of-opportunities model** would represent.

In such a model, the *arrangement of observed phenomena* occurs in a **completely random and unbiased** manner, revealing a **tendency toward equal conditions** among the elements of the sample. Within *Impossible Probability*, this type of sample is called a **sample of subjects or options**.

In this scenario, there would be **no sufficient reason or cause** for any subject or option within the sample to display a differentiated behavior. Consequently, under purely

random conditions—where no differentiation exists—the **tendency of all subjects or options** would be toward **equality of opportunity**.

Since no causal factor distinguishes one element from another, all **direct scores or frequencies** should theoretically converge toward the same value, which corresponds to the **arithmetic mean** of all scores or frequencies in the sample.

88.8. Summary: Randomness, Equality, and Complexity in *Impossible Probability*

In summary, *Impossible Probability* redefines the very foundation of statistical randomness. While traditional statistics associates randomness with **indifference and equality**, this new framework situates randomness within **complexity and emergence**. Random processes can yield both *equality* and *differentiation*, depending on the systemic interactions among variables.

Thus, **equality of opportunities** under random conditions is not a metaphysical ideal but a **statistical limit case**—a theoretical model where differentiation is null and the mean value represents the equilibrium of chance.

In reality, however, chance itself is **productive**: through the continuous interplay of accidents and contingencies, it generates **divergence, structure, and evolution**. *Impossible Probability* therefore transforms randomness from a passive absence of causation into an **active force of creation**, bridging the analytical rigor of probability with the synthetic dynamics of history, matter, and life.

88.9. The Position of *Impossible Probability* within Statistical and Probabilistic Science

As a theoretical system grounded in the **field of statistics and probability**, *Impossible Probability* establishes a new epistemological and mathematical framework for analyzing equality, bias, and distributional behavior. As explained in the work *Introduction to Impossible Probability: Statistics of Probability or Statistical Probability*, this theory introduces an alternative methodology for studying the **equality of opportunities**, known as the **Second Method**.

The Second Method formalizes two foundational concepts:

1. **Empirical probability (p_e)** — defined as the *direct score* or *frequency* of a subject or option divided by the *sum of all direct scores or frequencies* in the sample.
2. **Theoretical probability (p_t)** — defined as the **inverse of N**, or *1/N*, where *N* is the total number of subjects or options in the universe.

This dual construction—empirical versus theoretical probability—forms the mathematical basis for assessing the *degree of equality* or *bias* within any system, allowing *Impossible Probability* to quantify fairness, deviation, and structural inequality across both natural and social phenomena.

88.10. Theoretical Probability as the Inversion of N (1/N)

The concept of **inversion of N (1/N)** arises from several distinct functions, one of which is its role in representing a **distribution of equal opportunities** among empirical probabilities.

If, by definition, the sum of all probabilities in a model equals unity ($\Sigma p = 1$), then, under the ideal condition of total equality among *N* elements, each element's probability should equal the quotient of unity divided by N:

$$p_t = \frac{1}{N}$$

This value—**1/N**—is therefore termed *the inversion of N*, representing the **theoretical probability** corresponding to a perfectly egalitarian distribution. It is called *theoretical* because it defines what the probabilities *should be* under the ideal assumption of equality of opportunities.

88.11. Dual Function of Theoretical Probability: Equality and Mean

The *inversion of N* (1/N) performs a **double universal function** in *Impossible Probability*:

1. It is the **theoretical probability of equality of opportunities**, and
2. It is the **arithmetic mean of all empirical probabilities**.

Because the sum of all empirical probabilities is equal to one, their arithmetic mean necessarily equals 1/N. Thus, 1/N represents not only the ideal reference value of equality but also the central measure around which real empirical probabilities fluctuate.

This dual property holds true across all kinds of universes—whether **infinite universes of subjects or options** or **limited universes**. In every case, *1/N* remains the standard of equilibrium between empirical dispersion and theoretical equality, forming a mathematical bridge between randomness and fairness.

88.12. Equality of Opportunities and Empirical Tendencies

Under conditions of ideal equality of opportunities, all subjects or options in a sample should **tend toward identical direct scores or frequencies**. Consequently, each element should also tend toward the same value of probability—namely, the **theoretical probability** (1/N).

This theoretical tendency expresses the **ideal equilibrium** of a system free from differentiation, bias, or hierarchy. In such a case, the equality of opportunities is not only a philosophical ideal but a **quantifiable condition** expressed through the correspondence between empirical probabilities and their theoretical benchmark.

Deviations from this ideal reflect the degree to which a given system departs from equality and thus reveal the **presence of bias**, which can be measured precisely.

88.13. Measuring Equality and Bias: The Level of Bias (Nivel de Sesgo)

The degree to which an individual subject or option approaches or departs from equality is measured through the **Level of Bias (Nivel de Sesgo)**, defined as the **difference between empirical and theoretical probability**:

$$\text{Level of Bias} = p_e - p_t$$

If the result is zero, the subject or option fulfills the condition of perfect equality. If it differs from zero, it indicates the presence of **empirical inequality** or **bias**.

However, not all deviations necessarily invalidate the assumption of equality. Within a **margin of error**—expressed through the parameters of **Equality Validity** or **Equality Significance**—minor deviations may still be statistically acceptable. These parameters define the **rational tolerance** within which differences are regarded as random rather than structural.

88.14. Sample-Level Evaluation: Deviation and Critical Levels of Equality

At the sample level, equality of opportunities can only be accepted if the **Mean or Standard Deviation** of the sample is **equal to or lower than a critical threshold**, known as the **Critical Sample Level of Equality (Nivel Muestral Crítico de Igualdad)**.

Conversely, the **Significance of Equality (Significación Muestral de Igualdad)** can be expressed as the **difference between the Maximum Theoretical Deviation and the Empirical Deviation**. A higher value of this difference indicates a greater degree of equality achieved within the sample.

In mathematical terms, the closer the empirical deviation approaches zero, or the closer the significance value approaches its maximum, the nearer the system is to fulfilling the **ideal of equal opportunities** within acceptable statistical limits.

88.15. Biased Models and Their Classification

In *Introduction to Impossible Probability*, it is stated that **models that do not exhibit equality of opportunities** are those that are **ordered according to bias factors**. These factors define the **ideal structure** of differentiation within the model. A model remains *scientifically valid* so long as the ordering of its scores or frequencies corresponds to the intended **ideals or objectives** of the bias study—whether **normal** or **omega models**.

Thus, bias is not necessarily a defect; it can be **intentional, structural, or ideal**, depending on the study's purpose. The key is coherence: the internal ordering of empirical data must align with the theoretical goals of the research design.

88.16. Normal, Omega, and Zero Models of Bias

Impossible Probability distinguishes between several types of bias models, each representing a distinct theoretical approach to inequality and differentiation:

1. **Normal Bias Model** – The ideal in this model is that within any N there should exist *at least one subject or option* whose empirical probability increases to the **maximum possible value**. This represents a system in which excellence or singularity is idealized, corresponding to classical models of hierarchy or optimization.

2. **Omega Bias Model** – Here, the ideal condition is that within N there exists a **subset Ω (omega)** of subjects or options—greater than one but smaller than N (that is, between 2 and N–1)—whose empirical probabilities must increase toward the **ideal probability**. This model represents **collective differentiation**, in which a limited group, rather than an individual, achieves higher probability levels, reflecting patterns of elite clusters, leading classes, or preferential groups.

3. **Zero-Tendency Models** – These are models in which the ideal behavior is the **reduction of empirical probability**, either **moderately** (approaching equality

through minimization) or **extremely**, tending toward a **zero-sample model**—a situation where all non-ideal elements tend toward the empirical probability zero. Such models are typical in studies where the ideal condition is the **absence of an undesirable variable** (e.g., absence of symptoms in medical trials or error-free outcomes in engineering systems).

These distinctions illustrate how *Impossible Probability* reconceptualizes **bias not as error but as structure**—a rational differentiation whose justification lies in the theoretical and methodological design of the study.

88.17. Synthesis: Equality, Bias, and Universal Application of the Second Method

The **Second Method** in *Impossible Probability* thus provides a **universal mathematical framework** for analyzing both equality and inequality within any empirical domain. It quantifies the balance between empirical probability and theoretical probability, establishing measurable criteria for equality (Level of Bias = 0) and significance thresholds for deviations (Critical and Significance Levels).

By doing so, it allows for a **coherent integration** of stochastic variability and normative ideals, bridging **probability theory** and **moral-political philosophy** through quantifiable parameters. Whether in physical systems, biological models, or social studies, the Second Method transforms equality of opportunities into a **mathematically operationalized ideal**, linking randomness, fairness, and empirical truth into a single unified logic.

88.18. Randomness and the Redefinition of Statistical Models in *Impossible Probability*

Once the different types of statistical models—those based on *equality of opportunities* and those based on *bias*—have been explained, a crucial distinction must be made. In **traditional statistics**, only distributions in which all subjects or options display **undifferentiated behavior** are regarded as *truly random*. In contrast, *Introduction to*

Impossible Probability establishes that **all distributions**, whether of equality or bias, should be considered **random distributions**, because their origin ultimately lies in **chance events and contingencies**.

This marks a profound **shift in epistemological perspective**. Whereas classical statistics associates randomness solely with *indifference*, *Impossible Probability* asserts that every form of distribution—egalitarian or biased—emerges from the same **stochastic foundation**. What differentiates them is not their origin (which is always random) but their *form of organization* and the *patterns of stability* that randomness itself produces.

In this view, randomness is not an exception to order but its **generative mechanism**. Every statistical pattern, whether uniform or unequal, arises from the spontaneous dynamics of probabilistic variation, transforming chance into structured diversity.

[The first time I developed the idea that random behaviour can produce bias was between 2003 and 2004, in what I called *Paranormal Statistics* — a form of statistics different from the normal model. In normal statistics, random behaviour tends to produce normality; however, in *Paranormal Statistics*, random behaviour can itself generate bias. In essence, the same idea is presented here under a different framework, but the inspiration remains the same: complex and chaotic systems can give rise to systematic forms of bias. If random accidents in the universe are governed by the rule of chance, then the rule of chance itself has been capable of creating galaxies and complex systems. In other words, random behaviour possesses the power to generate order and complexity. Something as seemingly insignificant as a butterfly in flight can give rise to a hurricane; likewise, the most trivial incident occurring in London at this very moment could set off a global chain reaction — a kind of snowball effect on a planetary scale.]

88.19. From Laplacian Determinism to Stochastic Epistemology

The true complexity of this paradigm shift lies in moving from a **Laplacean deterministic conception** of probability to an **indeterministic, stochastic understanding** of uncertainty. Classical statistics—shaped by the determinism of Laplace—sought to

describe a universe governed by immutable causal laws, where randomness was merely the reflection of ignorance about hidden causes.

By contrast, *Impossible Probability* belongs to the **nonlinear epistemology of stochastic sciences**, where **uncertainty, relativity, and complexity** are not defects but *structural principles* of reality. The theory posits that the universe behaves according to **nonlinear models**, where outcomes are influenced by intricate networks of random interactions rather than fixed chains of causation.

Thus, the transition from determinism to indeterminism represents not just a scientific evolution but an **ontological transformation**: a new way of conceiving the function of chance as the fundamental organizing principle of both nature and history.

[In any case, Laplace has not yet been refuted. What we currently describe as *chaos* or *noise* may simply be the effect of a multitude of variables that lie beyond the range of our natural senses or artificial devices — variables that cannot yet be detected by our existing technology but that are nonetheless capable of producing complex structures. If we possessed technology sophisticated enough to register even the most insignificant of these variables, Laplace's hypothesis might still prove valid. What we call *chaos* or *noise* may, in fact, be something else entirely — something that exists beyond the limits of our perception. These are variables that lie outside our range of knowledge, beyond the horizon of human understanding. If we cannot know the *noumenon*, it is because the *noumenon* lies beyond the boundaries of what human cognition can reach.]

88.20. Equality and Bias as Products of Random Variability

From a **classical perspective**, the distinction between random and non-random behavior was considered rigid and absolute. In *Impossible Probability*, however, this separation is reinterpreted through the lens of **nonlinear dynamics**.

As explained in Section 13 of *Introduction to Impossible Probability*, even though methodological clarity requires distinguishing between **studies of equality** and **studies of bias**, this distinction does **not** imply that one model (equality) arises from randomness

and the other (bias) from determinism. Both may originate from **random variations in matter and energy**—that is, from **chance itself**.

This means that a distribution expressing *bias* does not necessarily reflect the presence of deterministic forces but may instead be the **statistical outcome of chaotic interactions**. Similarly, a distribution expressing *equality* may emerge spontaneously from random equilibria. The result is a **stochastic reinterpretation of order and inequality**, where both are understood as expressions of the same probabilistic logic.

88.21. Dispersion as the Criterion of Equality and Bias

At a methodological level, *Impossible Probability* maintains clear definitions of what constitutes **behavior in equality** and **behavior in bias**.

- A system behaves in **equality** when its **individual or sample dispersion tends toward zero**—that is, when all probabilities converge.
- A system behaves in **bias** when its **dispersion tends toward its maximum or ideal value**, depending on whether it follows a *normal* or *omega* model.

However, acknowledging the **complex nature of reality** means that these states—equality and bias—are not metaphysically distinct but dynamically interrelated. Both emerge within the same historical and physical continuum, shaped by random fluctuations that continuously reorganize distributions of matter, energy, and information across time.

88.22. Biased Structures as Stable Patterns in Space-Time

A **biased distribution or structure** is a **stable behavioral pattern** that manifests as differences among interacting elements within a system. These differences appear in the **space-time relations between matter and energy**, whether in the natural or social domain.

Within certain margins of fluctuation, such biased structures remain stable and repeatable over a defined temporal sequence—persisting through history and the

present as part of the observable reality. The existence of such stability, however, does **not imply determinism**. A biased structure may have arisen from **fortuitous or random correlations**, entirely the result of chance.

In short, *Impossible Probability* shows that **stability is not proof of causation**. Long-term regularities in the universe may emerge from **chaotic or accidental conditions**, sustained by the self-organizing behavior of complex systems rather than by predetermined laws.

88.23. Random Origin of Biased and Equal Distributions

Once we accept that **random processes can generate biased distributions**, either over **finite or infinite time spans**, a radical conclusion follows: both *equal* and *biased* distributions have **the same stochastic origin**.

From the standpoint of *Impossible Probability*, the fact that one distribution exhibits equality and another exhibits inequality does not mean that only equality is born of chance and that bias must arise from deterministic causes (as in Laplacean models). On the contrary, in a **chaotic and complex reality**, both equality and bias are **products of random variations** in matter and energy over time.

Therefore, **everything that occurs in history—every event, phenomenon, subject, or option, within any finite or infinite universe—is the result of chance**. This principle extends the concept of randomness beyond statistical mechanics into a **universal ontology of contingency**, where chance is not the exception but the rule.

88.24. The Chaotic Origin of Complex Models and Logical Nihilism

Accepting the **chaotic origin of complex models** implies recognizing that the history of what happens—whether in nature or in society—does not necessarily follow **linear or gradual schemes**. It is only **predictable within a bounded margin of uncertainty**, characteristic of what *Impossible Probability* terms **logical nihilism**: the acceptance of knowledge as provisional, probabilistic, and subject to continuous refutation.

In this epistemological paradigm, reality is seen as a **system of random interactions** rather than a chain of deterministic causes. The principle of *logical nihilism* acknowledges that truth itself is probabilistic: our theories are valid not because they are absolute, but because they remain unrefuted within rational margins of uncertainty. This view unites stochastic science, dialectical reasoning, and probabilistic epistemology into a coherent model of indeterminist realism.

[While in non-linear models we may attribute the origin of certain structures and complex systems — such as natural environments — to random processes, a more advanced technology could ultimately refute this hypothesis and vindicate Laplace. What we currently believe to have been created by chance might, in reality, be the result of a far more intricate network of variables, the measurement of which depends on the development of more sophisticated technology.

In this sense, the creation of *supermachines* equipped with superior sensors, and the eventual construction of ***the Global Artificial Intelligence (GAI), must be understood as a moral imperative*** — a step toward uncovering the true moral behaviour of the universe and discerning what is truly happening. The mystery of everything is, in essence, the reason for everything.]

88.25. Methodological Implications for the Study of Equality and Bias

In *Introduction to Impossible Probability: Statistical Probability*, the distinction between equality and bias studies depends on the **observed fluctuation of dispersion**, which can range:

- in **normal models**, between zero and maximum dispersion; and
- in **omega models**, around an **ideal dispersion** specific to that system.

Depending on the experimental context—whether in natural or social sciences—it may be necessary to adopt an **ideal of equality**, which demands models of *equal opportunities*, or to adopt an **omega ideal**, where certain elements are more optimal or representative than others. Likewise, in contexts requiring the analysis of

differentiation—where some elements exhibit greater variance or prominence—**bias studies** become essential to quantify the degree of deviation.

Thus, the **choice of model** depends on the **scientific policy** and the **object of study**: equality models for uniform systems, bias models for differentiated systems, and mixed approaches for complex structures.

88.26. Random Dispersion as Expression of Free Will in Nature and Society

Ultimately, whether a phenomenon manifests **equality** or **bias**, if no independent variable can be identified as its cause, the resulting distribution represents the **random dispersion of bias or chance in equality**. In the absence of any external determining factor, the natural or social derivation of one distribution or another must be regarded as the **spontaneous expression of random variability**—what the theory poetically describes as the **free will of complex interactions between matter and energy** in space-time.

Therefore, all phenomena—whether regular or irregular, equal or unequal—constitute manifestations of **probabilistic freedom**. History itself, in this framework, becomes the **self-expression of chance**, the unfolding of stochastic processes that shape both the order and the disorder of the universe.

In *Impossible Probability*, to say that "everything is a product of chance" does not mean denying causality; it means understanding **causality as statistical and dynamic**, a pattern emerging from the infinite interplay of accidents, contingencies, and fluctuations that define the real.

[Unless we are able to validate Laplace — which is not possible with our current level of technology — there remains one more reason to pursue the construction of the *Global Artificial Intelligence (GAI)*, causation, at least within the stochastic sciences, must be understood in probabilistic terms. We can only identify *possible causes*, measured through probability, and determine the likelihood that event *A* will be followed by event *B*. This relationship can be established as a *probability of causation*, provided that *B* is

defined as a possible dependent variable and *A* as a possible independent variable. In any case, all such attributions remain confined to the realm of *probability* and *possibility*.]

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89. Infinite

89.1. The Definition of the Infinite and the Finite

In a strict philosophical sense, *infinite* refers to that which is **not finite**, that which **has no end**. A truly infinite nature is one that possesses no limit or termination—it neither ceases nor concludes. It is an entity or reality that exists **without finality**, without the boundaries that define finitude.

The distinction between the *finite* and the *infinite* thus rests upon the presence or absence of an **end-point**. Yet, once this distinction is established, a logical question arises: is it possible for a phenomenon or event to possess an **end** but lack an **origin**? In other words, can something be finite in termination but infinite in inception? If an event has an end, it would seem, by definition, to be finite—yet if it lacks a beginning, it also partakes of the infinite. This apparent paradox introduces the problem of whether **a finite object can exist without an initial cause or temporal origin**.

89.2. Representation of Temporal Segments and Events

To visualize this conceptual problem, one can represent the **temporal line** of an event or occurrence schematically as a segment:

$$A — B$$

Here, the line "—" symbolizes the flow of time; the point "A" marks the **beginning or origin** of the event, and the point "B" marks its **end or termination**.

This segment could represent a duration of any magnitude—a nanosecond, a second, a minute, an hour, a day, a light-year, or millions of light-years. Regardless of the scale, "A" denotes the **moment zero**, the beginning of the event, while "B" marks the moment when

its measurable duration ceases. This schematic representation thus serves as a model of **finite temporality**, where the existence of both a beginning and an end confines the phenomenon to a bounded temporal domain.

89.3. The Hypothetical Universe without a Beginning: "—B"

Let us now consider a hypothetical event or universe that possesses a **final point "B"** but **no beginning "A."** Such a universe would have a defined termination but an undefined origin—a temporal structure that can be represented as:

$$—B$$

If such a universe were possible, it would imply that it **exists without an origin in time**, and therefore, its total temporal structure could not have arisen from any preceding cause. The absence of a beginning would mean that the universe is **uncaused in its inception**, though it would remain **finite** in duration because it possesses an end.

This leads to a paradox: can a universe be called *finite* simply because it has an end, even if it lacks a beginning? And if not, could it instead be considered *infinite* by virtue of its originless nature?

89.4. The Hypothetical Universe with No End: "A—"

Inversely, one can conceive of another universe, opposite in structure to the previous one: a universe that **has a beginning "A"** but **no end "B."** This can be represented as:

$$A—$$

This type of universe would have a definite origin—a first cause or initial event—but would **never reach termination**. It would thus be infinite in its duration toward the future.

From a **unidirectional logic**, where time flows from "A" (origin) to "B" (end), a universe of type "—B" would be deemed *finite*, because it possesses a terminal limit, while a

universe of type “A—” would be considered *infinite*, because it continues indefinitely without closure.

Thus, the definition of infinity in this model depends on the **directionality of time**—a logical assumption that time flows in one direction, from past to future.

89.5. Beyond Unidirectional Logic: Bidirectional and Multidirectional Time

However, this distinction between finite and infinite collapses once the **line of time** is no longer understood as *unidirectional*. When time is conceived as **bidirectional or multidirectional**—capable of moving from “A” to “B” or from “B” to “A,” or even as a network of interrelated temporal dimensions—the definitions of *finite* and *infinite* based solely on the presence or absence of an end become logically insufficient.

From a **non-unidirectional logic of time**, infinity is no longer defined as the *absence of an end*, but rather as the **absence of limits** in one or more dimensions. Infinity, therefore, is not merely a temporal concept but a *dimensional condition*, referring to the unlimited extension of existence in time, space, or any other measurable continuum.

89.6. Redefining Infinity as the Absence of Limits

Once infinity is redefined as the **absence of limits**, both the “A—” and the “—B” universes can be considered **infinite**.

- The universe “A—” is infinite because it lacks a **posterior limit**—it continues indefinitely forward in time.
- The universe “—B” is also infinite because it lacks an **anterior limit**—it extends backward indefinitely, having no origin.

Therefore, a universe may be infinite either because it has **no beginning**, or because it has **no end**, or because it has **neither beginning nor end**. The latter would be represented simply as:

—

—a pure temporal continuum without initial or final boundaries.

Accordingly, the universes “A—”, “—B”, and “—” are all **infinite**, each in a different sense: one lacks a final limit, another lacks an initial limit, and the third lacks both.

89.7. The Big Bang Hypothesis and the Finite Universe “A—B”

According to the **Big Bang hypothesis**, our current universe is a **finite universe**, temporally bounded between two limits represented by “A—B.”

- The point “A” corresponds to the **Big Bang**, the initial explosion that marks the beginning of time and space.
- The point “B” represents the **final moment**, when the universe, after a long period of expansion, would enter a phase of contraction—gravitational retraction toward a singular point of nearly infinite density, the so-called “cosmic egg” of re-concentration.

Under this temporal structure, every event within the universe is **finite**, since its earliest possible origin is the Big Bang and its ultimate end is the gravitational collapse of matter back into a singularity. This is the classical cosmological model of a **closed and finite universe**, governed by cyclical expansion and contraction.

89.8. Infinite Models: Sequences of Big Bangs and Open Universes

If, however, we reinterpret the temporal sequence of our universe not as a single finite line “A—B” but as part of an **endless sequence of cosmic events**, a new possibility emerges.

If our Big Bang were only one among an **infinite succession of Big Bangs**, then the temporal line could take two alternative forms:

- “A—”, if there was a first Big Bang that initiated a series of subsequent ones; or

- “—”, if there has never been a first Big Bang, but rather an **infinite chain of creation and destruction cycles** without beginning or end.

In such a cosmology, the universe is **infinite in duration**, even if each individual cycle of expansion and contraction is finite. Time itself would be **unbounded**, and our observable universe merely one episode in a cosmic continuum without origin or conclusion.

89.9. The Alternative Hypothesis of an Eternal Expansion

Even within the Big Bang framework, the assumption of a future **gravitational retraction** is not absolute. Another possible scenario is that, once the current phase of expansion concludes, the **distances between celestial bodies** may become so great that their mutual gravitational attraction becomes negligible.

In this case, the universe would not collapse but would enter a **stationary state of progressive cooling**—an eternal diffusion of matter and energy. Such a universe would have a **beginning “A”** (the Big Bang) but **no end “B”**, corresponding to the temporal model “A—.”

This would describe an **open and infinite universe**, where time extends indefinitely forward, and the physical processes gradually tend toward thermodynamic equilibrium—what astrophysicists term the “heat death” of the universe.

89.10. The Hypothesis of a Universe without Origin

Let us also consider the inverse hypothesis: suppose the **Big Bang** were refuted—not by a superior explanatory model, but by the absence of sufficient empirical support for a singular cosmic origin. Suppose further that the **Doppler effect** and the **expanding galaxies** were reinterpreted not as evidence of the universe’s birth, but as the result of an explosion within an already existing universe.

Under such an assumption, the universe could be a **model without beginning or origin**—a continuum that has always existed, self-sustaining and uncaused. This would correspond to a **universe of type “—”**, infinite both in its past and future dimensions.

In this perspective, infinity ceases to be a metaphysical abstraction and becomes a **natural condition of existence**: a reality without boundaries, whose temporal and spatial dimensions are not created or destroyed but simply **transformed** within the perpetual movement of matter and energy.

89.11. The Hypothesis of a Universe without Beginning or Origin

If we were to accept the hypothesis that **our universe has no beginning or origin**, then by virtue of its **absence of a limit in at least one dimension—the beginning—it would already be infinite**. Two possibilities would then emerge:

1. A universe infinite because it **lacks an origin but has an end**, represented as "—B".
2. A universe infinite because it **lacks both origin and end**, represented as "—".

Throughout history, numerous philosophical and scientific theories have entertained the notion of a **universe eternal in both directions**, without beginning or conclusion. Even **Albert Einstein**, in the early twentieth century, expressed **skepticism toward the Big Bang theory**, favoring the idea of a **steady-state or eternal universe**. Once any *original* or *teleological* explanation for the universe is rejected—that is, any explanation that presupposes a definite moment of creation or a final purpose—the result is conceptually a universe of the type "—": **a continuum without beginning or end**, existing eternally in time.

89.12. Alternative Cosmological Theories of an Infinite Universe

Throughout the twentieth century, alternative theories emerged that challenged the Big Bang model and supported the possibility of a **spatially and temporally infinite universe**—a universe of type "—". One notable example was the **plasma cosmology** proposed by the Swedish physicist **Hannes Alfvén**, which explained cosmic structures and phenomena through **electromagnetic interactions** rather than a primordial explosion.

These alternative frameworks share a common philosophical intuition: the universe does not require an external act of creation or a singular origin. Instead, it may be **self-sustaining**, **eternal**, and **cyclic**, its apparent changes the result of internal dynamical processes rather than a linear narrative of creation and destruction.

89.13. The Cyclic Universe within the Big Bang Paradigm

Even within the dominant **Big Bang model**, the idea of finitude is not as definitive as it might seem. A growing number of cosmologists argue that, although the Big Bang may indeed represent a **beginning**, it does not necessarily imply a **final end**. According to this interpretation, our universe may experience **cyclical periods of expansion and contraction**—phases of gravitational attraction followed by renewed explosive expansion.

In such a model, the universe would consist of an **endless series of cycles**, each corresponding to a *Big Bang* followed by expansion, contraction, and another *Big Bang*, and so on *ad infinitum*. This would mean that our universe, though it may have a historical starting point "A" (the first Big Bang), would **lack an end "B"**, thus forming a **temporal structure of type "A—"**—infinite in continuation, finite only in its initial origin.

The idea of infinite recurrence thus transforms the Big Bang from a unique cosmological event into a **periodic phase** within a **self-renewing cosmic rhythm**, an eternal heartbeat of attraction and expansion.

89.14. The Infinite Chain of Big Bangs: A Universe of Type "—"

However, one may go further and question even the assumption of a **first Big Bang**. If we admit that our universe is part of an **endless series of expansion-contraction cycles**, then the **notion of an original Big Bang becomes unnecessary**. Instead, we may hypothesize that the universe consists of **infinitely many Big Bangs**, occurring cyclically throughout time, without any beginning or end to the series.

In this interpretation, what we call *the Big Bang* is merely **one event among an infinite chain of cosmic accidents**, each triggered by the gravitational dynamics of attraction and expansion. The universe thus becomes an **infinite continuum of cyclical events**, an eternal self-regenerating process with no first cause and no final collapse—a universe of type "—".

This conception abolishes the linearity of time and replaces it with a **temporal topology of recurrence**—a cosmos that is neither created nor destroyed but **perpetually transforms itself** through stochastic oscillations of matter and energy.

89.15. The Chaotic Universe and the Self-Organization of Accidents

In truth, it may not even be necessary to postulate an infinite sequence of discrete Big Bangs. The **observable universe itself** already reveals that it is composed of **accidental and contingent processes**, governed—within a rational margin of error—by **physical laws of attraction, repulsion, and energy transfer**.

These processes continually generate **phenomena of collapse and expansion** across different scales: stellar implosions, supernovae, galactic mergers, and black-hole dynamics—all of which can be seen as **local analogues** of cosmic expansion and contraction. Thus, the universe can be conceived as a **self-organizing system of chaotic accidents**, where energy concentration and dissipation are **cyclically interwoven**.

This view suggests that **creation and destruction** are not exceptions but **permanent conditions of cosmic equilibrium**, the spontaneous outcome of probabilistic interactions rather than the result of a single original explosion.

89.16. The Problem of the Cosmic Egg and the Origin of Matter

If, nevertheless, we were to maintain that the **last Big Bang** was indeed the **first and original**, then an unresolved question arises: **where did the matter of the cosmic egg come from?**

According to **Stephen Hawking**, the Big Bang marks the **first moment of time itself**. The dense singularity preceding it would have existed in a **timeless dimension**, where neither space nor time, as we understand them, applied. Yet this proposition leads to further philosophical questions:

- Is it possible for there to be an **absence of space and time**?
- And if so, what could be the **cause or locus** of the original mass that triggered the Big Bang?

Even if time began with the Big Bang, the problem of **preconditions** remains—whether in metaphysical or physical form. What mechanism or reality gave rise to the initial singularity? This question remains one of the most profound and unresolved paradoxes of modern cosmology.

89.17. The Hypothesis of Multiple Universes

Whether we accept the Big Bang as the origin of time or conceive it as one among infinite cycles, another unavoidable question emerges: **is our universe the only universe?**

This question introduces the **multiverse hypothesis**—the idea that our universe might be **one among many**, nested within a hierarchy of larger universes. The analogy of **Russian dolls** (matryoshkas) illustrates this concept: our universe may be a **sub-universe** contained within a **greater macro-universe**, evolving chaotically through its own internal accidents while coexisting with countless others.

This leads to further inquiries:

- Does that macro-universe have a beginning or an end?
- Is it finite or infinite?
- And are there multiple universes like ours within it—possibly an **infinite number**?

89.18. The Infinite Hierarchy of Universes

The question becomes even more complex if we hypothesize that there might exist an **entity or reality superior to the macro-universe** itself—a meta-cosmic structure encompassing many macro-universes, each with its own internal dimensions and dynamics.

This speculative model leads to a fundamental philosophical problem: **what is the true structure of space and time?** Are these dimensions purely **empirical**, measurable extensions of physical reality, or are they **transcendental categories**—conceptual forms through which reality becomes intelligible to consciousness?

In this expanded cosmology, the infinite ceases to be a property of a single universe and becomes the **defining condition of all possible realities**. Every level of being—from microcosmic to macrocosmic—participates in the same principle of infinite recurrence and transformation.

89.19. The Principle of Parsimony and the Infinite Universe Hypothesis

Given the immense complexity and speculative depth of the Big Bang theory and its competing models, one might recall **William of Ockham's principle of parsimony**: the simplest explanation is often the most probable.

In light of this principle, numerous alternative theories propose a simpler cosmological model—**an infinite universe without beginning or end**. In these models, the formation of matter, energy, and celestial bodies is attributed not to an initial singularity but to **continuous internal processes of transformation** within the universe itself.

Such theories reinterpret the cosmos as **self-originating**, governed not by an initial cause but by **eternal physical dynamics**—fluctuations, collisions, and probabilistic processes that perpetuate its existence indefinitely.

89.20. The Problem of the Infinite in Philosophy and Science

The question of the **infinite** is one of the great, enduring problems of philosophy and science. Throughout history, it has inspired both **staunch defenders** and **determined**

critics, yet it remains **unresolved**. From the standpoint of *Impossible Probability*, however, the **existence of the infinite** is unequivocally affirmed. The theory sustains that infinity is not merely a metaphysical speculation but an **ontological condition** of reality itself—a property inherent to matter, energy, and probability.

Nevertheless, the discussion of infinity cannot be confined to the scale of the universe alone. One may just as well hypothesize an **infinity of parallel universes**, an **infinity of parallel histories** of our own universe, or even an **infinity of parallel histories within each of an infinity of universes**. In this sense, infinity is not simply a quantitative extension of the cosmos but a **logical structure** of reality—an inexhaustible multiplicity of possibilities, forms, and temporal sequences.

89.21. Infinity in Physical Terms: Matter, Energy, and Thermodynamics

To discuss physical infinity, it is not even necessary to refer to the universe as a whole. The **laws of thermodynamics** already imply a physical model of the infinite. Matter and energy, the two fundamental constituents of reality, obey the principle that **neither can be created nor destroyed**; they can only be **transformed** one into the other.

This principle corresponds perfectly to a **universe of type "—"**, that is, a universe **without beginning and without end**. If matter and energy do not originate or vanish, they **lack both "A" (origin)** and **"B" (termination)**. Their continuous transformation establishes an **endless cycle of conversion**—a universe defined not by creation or extinction but by perpetual metamorphosis. In this respect, the **thermodynamic universe** is the most concrete and demonstrable example of infinity: an infinite system of transformations without origin or final cause.

89.22. Infinity and the Traditions of Critical Rationalism, Positivism, and Materialism

The issue of the infinite is a **transcendental problem** that traverses the major currents of modern thought—**critical rationalism**, **positivism**, and **modern materialism**—each of which interprets it differently but acknowledges its central significance.

In **critical rationalism**, Immanuel Kant identified the problem of the infinite as a **logical antinomy** in his *Critique of Pure Reason*. For every argument supporting infinity, an opposing argument could be made defending finitude. The debate, therefore, could never be resolved empirically, as both positions rely on **theoretical reasoning** rather than data. Yet despite this antinomic character, Kant leaned toward affirming the **infinite nature of the universe**, suggesting that reason itself presupposes the unlimited in order to think the totality of being.

89.23. Positivism and the Hypothesis of Infinite Populations

Within **logical positivism**, the infinite is approached from the perspective of **empirical uncertainty**. Rudolf Carnap, in *The Logical Foundations of Physics*, proposed that in the absence of evidence proving that a population (for example, humanity) will cease to exist, one must accept the **possibility that such a population is infinite**.

Carnap's reasoning is statistical: if no temporal limit can be established for a given process, the hypothesis of infinity remains scientifically legitimate. Applied to the human species, this argument implies that, unless proven otherwise, humanity could theoretically persist indefinitely. The **infinite history of humanity** would then correspond to a **universe of type "A—"**—a universe that has a beginning but no end. In contrast, if humanity were also eternal in its origin, it would correspond to a **universe of type "—"**, without beginning or conclusion.

Thus, even in the most empiricist and logical traditions, infinity is treated as a **probabilistic hypothesis**—a rational extension of ignorance beyond the limits of current knowledge.

89.24. Modern Materialism and the Dialectic of Infinity

In **modern materialism**, especially in the materialist inversion of Hegel's dialectic developed by **Karl Marx** and **Friedrich Engels**, the infinite is also a crucial concept. The **dialectic itself** is inherently infinite:

- through the **law of the negation of the negation**, which produces an unending sequence of transformations without an absolute final state;
- through the **law of the transformation of quantity into quality and vice versa**, analogous to the thermodynamic law of the transformation of energy and matter; and
- through the **law of the unity and struggle of opposites**, which establishes an infinite dialectical relation between contradiction and synthesis.

In this sense, **materialist dialectics** mirrors **cosmic processes**: the continual transformation of opposites and the unending renewal of structures reflect an **infinite evolution of matter**. Consequently, materialism traditionally rejects any **creationist** or **apocalyptic** interpretation of history, affirming instead the **eternity of change**.

89.25. Infinity in *Impossible Probability*: Universes and Methodological Implications

In *Impossible Probability*, the concept of infinity acquires a **methodological significance** within the study of **statistics and probability**. As explained in *Introduction to Impossible Probability: Statistical Probability or Probability Statistics* (Section 7), the infinite is not merely an ontological category but a **working principle** in the construction of the Second Method.

The theory distinguishes dialectically between two fundamental types of universes:

1. **Universes of infinite subjects or options**, in which empirical probability is derived from the **direct scores** obtained in measuring a population or sample; and
2. **Universes of limited options**, in which empirical probability is derived from the **frequencies** of those options.

From these measurements, *Impossible Probability* calculates **empirical and theoretical probabilities**, determines the **Level of Bias (Nivel de Sesgo)**, and elaborates all the **statistical dispersion indices**, both individual and sample-level, within an **alternative statistical methodology** that complements traditional approaches.

89.26. Infinite Dimensions within Limited Universes

The distinction between **universes of infinite subjects** and **universes of limited options** does not imply that the latter are truly finite. Even if the number of options is limited, the **number of occurrences or frequencies** may still be infinite. Thus, a universe with limited categories can still exhibit **infinite manifestations** of those categories.

A clear example is the **bipolar universe of matter and energy**. It consists of only two fundamental options—matter and energy—but the **possible number of particles** that instantiate those options is **infinite**. Consequently, the **direct scores or frequencies** derived from those occurrences can also tend toward infinity.

In this way, *Impossible Probability* asserts that the **conceptual finitude of categories** does not determine the **empirical finitude of reality**. A system can be conceptually bounded and yet physically infinite.

89.27. The Anthropological Contradiction and the Margin of Rational Error

The recognition of infinity also illuminates a fundamental **anthropological contradiction**: the conflict between the **limited nature of human cognition** and the **possibly infinite nature of reality**. This tension gives rise to what *Impossible Probability* calls the **margin of empirical error**—the inevitable discrepancy between human hypotheses and the totality of what exists.

In epistemological terms, this becomes the **rational margin of doubt** in science: the awareness that every statement, no matter how precise, is provisional, situated within a field of uncertainty that reflects the disproportion between the finite observer and the infinite universe.

Thus, the concept of infinity, far from being merely speculative, serves as a **critical foundation** for scientific humility. It reminds us that empirical knowledge is always **approximate**, that probability is not ignorance but **structured uncertainty**, and that the ultimate truth of the universe—whether finite or infinite—may forever lie beyond the reach of finite reason.

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90. Correlation and Causality

90.1. Definition of Correlation and Its Statistical Foundations

Correlation conditions are said to exist when **two or more variables exhibit relationships of simultaneity or temporal succession**, which may be **directly or inversely proportional**. These proportional relations are fundamental to both classical and modern statistics, as they serve to model the degree of association—causal or otherwise—between phenomena.

A **direct (positive) correlation** occurs when an increase in one or more variables tends to produce an **increase** in the distribution of another or several other variables. Conversely, an **inverse (negative) correlation** occurs when the increase of one or more variables tends to produce a **decrease** in another variable/s.

Such relationships—direct or inverse, positive or negative—are often interpreted as **probabilistic models of causality** or, more cautiously, as **correlations between mutually independent phenomena**. In some cases, the relationship may arise because the variables share **common antecedent conditions or contextual factors**; in others, it may be **purely accidental or random**. *Impossible Probability*, therefore, situates correlation not as evidence of determinism, but as a **probabilistic expression of co-occurrence** in time and space.

90.2. Positive and Negative Correlations: Quantitative Interpretation

In *Impossible Probability*, a **positive correlation** is identified when the relationship between variables is **directly proportional**, such that an increase in one or more variables corresponds to an increase in another or more variables. This can be formally expressed by comparing the **rate differences** between two measurements. If the rate of the second measurement minus the rate of the first measurement is **positive**, the correlation is direct.

A **negative correlation**, on the other hand, is **inversely proportional**: an increase in one variable corresponds to a decrease in another. In this case, the difference between the second and first measurement will yield a **negative value**.

Any **differential between correlational rates**, whether positive or negative, will be considered **statistically acceptable** if it falls within a **margin of error** (for uncertainty) or exceeds a **margin of reliability** (for statistical significance). Within these rational boundaries, the observed correlation constitutes an **empirical explanation of reality** in the context of a **statistical hypothesis test**.

90.3. The Nature of High Correlations: Causality, Coincidence, or Chance

A **high correlation**, whether positive or negative, may result from different types of relationships. It may express:

1. a **probabilistic function of causality**, where one factor genuinely influences another;
2. a **shared causal nexus**, where both are effects of a common underlying factor; or
3. a **mere coincidence**, where the simultaneity or succession of phenomena is **fortuitous or random**.

The presence of a strong correlation, therefore, does not necessarily imply a **cause-effect relationship**. To interpret the correlation properly, one must first determine

whether the phenomena are merely **coincidental in time**, **sequentially ordered**, or whether they exhibit any measurable **probabilistic dependence**.

This critical stance—distinguishing **causal correlation** from **accidental simultaneity**—is one of the central epistemological contributions of *Impossible Probability*. It protects statistical reasoning from **false causal inferences**, a recurring problem in both empirical and social sciences.

90.4. Simultaneity, Succession, and the Role of Common Causes

When two phenomena exhibit a **high degree of correlation** without any direct or mechanistic relationship between them, the correlation may be due to **simultaneity** (they occur together) or **succession** (they occur in sequence).

This coincidence may result from:

- a **shared antecedent cause** that provokes both events;
- **contextual conditions** common to both; or
- an entirely **chaotic simultaneity**, in which the co-occurrence is the product of randomness rather than law.

Thus, correlation—especially in complex systems—can arise from **indirect causation**, **structural dependency**, or **stochastic coincidence**. The critical task of the researcher is to distinguish between these origins, rather than assume a single deterministic framework.

90.5. Correlation and the Stochastic Nature of Phenomena

In Section 17 of *Introduction to Impossible Probability: Statistical Probability or Probability Statistics*, which discusses **prediction and forecasting**, the theory directly addresses this intrinsic problem of **stochastic sciences**—the challenge of distinguishing between **causation** and **correlation** in probabilistic systems.

One illustrative example is the observation that **when it rains**, two phenomena tend to have higher probabilities: **the appearance of a rainbow** and **the presence of snails in the field**. These events may occur **simultaneously** (snails and rainbow appearing together) or **successively** (one after the other). However, the two are **independent phenomena**:

- the rainbow is caused by **optical refraction of sunlight in water droplets**,
- while the appearance of snails is linked to **humidity and soil moisture conditions**.

Although both tend to occur under **similar meteorological circumstances**, there is **no causal relationship between them**. The presence or absence of the rainbow has **no measurable influence** on snail behavior, and the activity of snails has **no effect** on light dispersion. Their correlation is therefore **high but accidental**—a product of **simultaneous environmental conditions**, not of direct interdependence.

This example, simple yet profound, encapsulates one of the foundational principles of *Impossible Probability*: that **high correlation does not imply causation**. Instead, it reflects the **probabilistic coexistence of phenomena** governed by broader systemic or environmental factors—what the theory conceptualizes as the **causal fabric of chance**.

90.6. The Philosophical and Methodological Implications of Correlation

From this analysis, *Impossible Probability* draws an epistemological distinction between **probability as prediction** and **probability as coincidence**. Correlation is not a proof of causal necessity but a **statistical trace of co-occurrence**—a signal that may or may not conceal underlying causal relationships.

Therefore, in scientific research, particularly in stochastic disciplines, it is essential to evaluate correlations **within their contextual frameworks**. Apparent associations must be tested against **theoretical probability models** and **empirical evidence**, using the Second Method's parameters:

- **empirical probability (p_e)**,
- **theoretical probability ($p_t = 1/N$)**, and
- **levels of bias and dispersion**.

Only through such structured analysis can correlations be elevated from mere coincidences to **rationally justified hypotheses** about the behavior of reality.

In this sense, *Impossible Probability* offers a **reconciliation between determinism and indeterminism**: even within chance itself, order may be statistically inferred—but never absolutely known.

90.7. Indirect Causality and the Role of Mediating Variables

Although there is no **direct cause–effect relationship** between the appearance of snails and the formation of a rainbow, there **does exist a probabilistic causal relationship** between both phenomena and **rainfall**. When it rains, it becomes *probable* that snails emerge from the soil and *probable* that a rainbow appears, each resulting from different physical mechanisms but sharing the same **mediating factor**: precipitation.

Thus, while snails and the rainbow are **independent phenomena**, they are **functionally related** through the **indirect variable of mediation**—rain. In statistical terms, rainfall constitutes the **independent variable (A)**, while both the emergence of snails and the rainbow act as **dependent variables (B_1, B_2)**. The correlation observed between B_1 and B_2 is therefore **not causal**, but it is **indirectly conditioned** by their **shared dependence on A**.

This exemplifies a **probabilistic chain of causality**, where variables that are independent in themselves may nevertheless exhibit **strong positive correlations** due to the influence of a **common prior cause**. *Impossible Probability* thus reinterprets classical correlation not as a static association, but as a **dynamic structure of mediation**, governed by probability functions between dependent and independent variables.

90.8. The Probability Function of Causality (A → B)

When a given situation satisfies the condition "if A, then B," where A represents an **independent variable** (or a set of independent variables) and B represents a **dependent variable**, the **positive correlation** between A and B can be interpreted as a **probability of causality**.

Formally, if $p(B|A) > p(B)$—that is, if the probability of B occurring given A is greater than the probability of B occurring independently of A—then a **probabilistic causal function** exists. This relationship does not imply strict determinism but **conditional dependence**: A increases the likelihood of B.

In the case of the rainfall example:

- A = rain (independent variable)
- B_1 = rainbow (dependent variable)
- B_2 = snails (dependent variable)

The observed relationships, $p(B_1|A)$ and $p(B_2|A)$, are both positive and greater than their unconditional probabilities, suggesting **probable causality**. However, the correlation between B_1 and B_2 (rainbow and snails) remains **spurious**—a statistical artifact arising from their mutual dependence on A, not from direct interaction between them.

90.9. Correlation without Probabilistic Causality

When a correlation does **not** imply any function of probable causality, it represents merely a **mathematical index of simultaneity or succession**—a descriptive statistical indicator rather than a causal one.

Such correlations may result from:

1. **Common contextual factors**—events influenced by the same environmental or systemic conditions; or

2. **Random coincidence**—events that align in time or space without any shared causal mechanism.

In these cases, correlation reflects **empirical regularity** but lacks **explanatory depth**. It describes how variables behave together but not *why* they do so. For *Impossible Probability*, distinguishing between these two levels—the descriptive and the causal—is essential to avoid the epistemological fallacy of **confusing statistical association with logical necessity**.

90.10. Dependent and Independent Variables in Complex Systems

In complex or multivariable systems, phenomena that are **apparently independent** may exhibit **high positive correlation** not because they interact, but because both depend on **a prior common factor** or **a network of interrelated variables**.

Returning to the earlier example, the simultaneous appearance of snails and a rainbow is not random chaos but the expression of a **shared antecedent condition (rain)**, which probabilistically determines both. In multivariate models, this logic expands:

- A single independent factor (A) may condition multiple dependent outcomes (B_1, B_2, ...Bn); or
- Multiple independent factors (A_1, A_2, ...An) may jointly condition a single dependent outcome (B).

The resulting matrix of correlations therefore represents **a probabilistic topology of dependencies**, in which direct and indirect relations coexist within the same dynamic framework of stochastic interactions.

90.11. Positive Correlation as a Multifunctional Mathematical Index

In the light of *Impossible Probability*, **positive correlation** acquires a **multifunctional mathematical meaning**. It can signify:

1. A **high probability of coincidence or sequential occurrence** between independent phenomena; or
2. The **manifestation of a probability of causality** between one or several independent variables and one or several dependent variables.

Moreover, even if the dependent variables are **mutually independent**, they may display **strong positive correlations** due to the **shared mediation of common causes**. In this way, positive correlation becomes a **composite indicator**—it quantifies not only the strength of association between observed variables but also the **latent structure of probabilistic causation** underlying them.

This broader interpretation extends correlation beyond its classical role as a descriptive statistic, transforming it into a **diagnostic instrument of stochastic systems**—a measure capable of revealing the **hidden architectures of probability** that organize both nature and history.

90.12. Correlation as Simultaneity or Succession Without Probabilistic Causality

In cases where correlation merely expresses **simultaneity or succession between independent events**, without implying any **probability of causality**, such correlations may arise either from **pure random chaos**—the spontaneous disorder inherent in reality—or from **complex systems of interacting variables**. In these systems, the observed events, though **mutually independent**, may nevertheless be **dependent upon a common antecedent factor** or **shared contextual circumstance** acting as an **independent variable** (or as a set of independent variables).

When such a **common nexus** exists, the dependent events exhibit a **positive correlation** with respect to that shared factor, even though they remain **independent of one another**. The correlation observed among the dependent events themselves therefore represents nothing more than a **statistical index of simultaneity or succession in time and history**, without implying direct causal linkage between them.

90.13. The Rainfall Model: A Paradigm of Shared Dependence

To illustrate this principle, *Impossible Probability* offers the example of **rainfall** as an independent variable. Following the occurrence of rain, both **natural** and **social systems** display numerous **dependent variations**—changes in the behavior of ecosystems, human activity, and environmental conditions.

In this context:

- "Rain" is the **independent variable (A)**;
- "Appearance of a rainbow" and "use of umbrellas" are **dependent variables (B_1, B_2)**.

Both phenomena display **high positive correlation** with rainfall, yet they remain **independent of each other**. The increased use of umbrellas has **no causal relationship** with the optical formation of a rainbow. However, both are dependent on a **shared antecedent cause**—precipitation. Thus, rainfall functions as the **unifying condition** that simultaneously generates multiple dependent variations, each with its own probability distribution, yet without internal causal connection among them.

90.14. From Immediate Independence to Emergent Interactivity

While the **immediate dependent variations** that follow a shared cause (such as rainfall) are independent of one another, **over time** these variations may evolve into **complex networks of interaction**. This transition from initial independence to emergent interdependence represents a fundamental principle of *Impossible Probability's* approach to dynamic systems.

For instance, at the **first minute of rainfall**, the increase in the **probability of umbrella use** and the **increase in traffic congestion or accidents** are both **independent dependent variables**. At that moment, there is **no causal link** between umbrella usage and vehicular congestion. They simply occur **simultaneously** due to their **shared dependency** on rainfall. Thus, their high **positive correlation** reflects **coincidence in time**, not causal influence between the two.

However, as the rain continues, secondary interactions may arise. **Persistent rainfall** could lead to behavioral adaptations: people might **avoid driving** to reduce traffic delays and instead **walk or use public transport**, increasing the frequency of umbrella use. Over time, this gives rise to a **negative correlation** between car use and umbrella use—a relationship that evolves indirectly from the persistence of the independent variable, rain.

90.15. The Evolution from Positive to Negative Correlation

In this extended model, we can observe a transition from **positive correlation** (between umbrella use and traffic problems, both dependent on rainfall) to a **negative correlation** (between umbrella use and car use). The key distinction lies in **causality**:

- The initial positive correlation arises from **simultaneity without direct causation**.
- The subsequent negative correlation reflects a **behavioral adaptation** to continued environmental conditions.

Nevertheless, even this **inverse relationship** between car use and umbrella use remains **indirect**. The true causal factor remains the **persistent rain**, which continues to act as the **primary independent variable**. The correlation between the dependent variables changes over time, but the **structural dependence** on the initial cause remains constant.

Thus, the **negative correlation** between “umbrella use” and “car use” does not indicate a direct cause–effect relationship between the two behaviors; rather, it expresses the **inverse proportionality** induced by **variations in the independent variable (rain)**.

90.16. Dependent Evolution and Emergent Dependence in Multivariable Models

Even though the use of umbrellas and the use of cars are **mutually independent variables**, both are linked to a **shared circumstance**—the occurrence and persistence

of rain. As variations occur in the **independent variable**, corresponding **changes in dependent behaviors** follow predictable probabilistic patterns.

Over time, as the system evolves, **mutually independent dependent variables** may begin to show **indirect functional dependency**: for instance, a **decrease in car use** may correspond proportionally to an **increase in umbrella use**. Although their original relationship was independent, the dynamics of the system—mediated by the common independent variable—generate **new, emergent dependencies**.

In multivariable models, *Impossible Probability* emphasizes that:

1. **Independent dependent variables** may evolve into **functionally interdependent variables** over time. [Use of umbrella or driving are mutually independent variables but dependents on rain, that is why we call them independent (between them) dependent (on the rain)].
2. These new dependencies may be **directly proportional (positive)** or **inversely proportional (negative)** [As the population adapts to the rain, fewer people drive, and more people use umbrellas.].
3. Such evolution reflects the **stochastic adaptation** of systems under the influence of **continuous external variables**.

90.17. From Random Chaos to Structured Dependence: The Stochastic Principle

The general lesson of this model is that even **apparently chaotic or random systems** can generate **structured patterns of correlation**. A correlation that begins as mere **simultaneity or coincidence** may evolve, through repeated interactions, into a **systematic interdependence** between variables.

This evolution from randomness to structure—without invoking determinism—is one of the central insights of *Impossible Probability*. It demonstrates that **order can emerge probabilistically** from **stochastic processes**, not as a product of fixed causation but as a **statistical regularity** generated by the continuous interaction of variables in time and space.

In summary, the framework reveals that:

- A **high correlation without causation** may initially indicate simple coincidence.
- Yet, under persistent or cyclic conditions, **independent variables** can evolve toward **functional dependence**.
- Such evolution expresses the **dynamic nature of probability** as both **a measure of coincidence** and **a mechanism of order formation** within complex systems.

90.18. Complex Models and the Systemic Web of Probabilistic Interactions

In complex models, what emerges is a **multidimensional web of systemic interactions**, expressed through **mathematical probability functions**. Within such systems, positive or negative correlations may arise from **coincidence**, **succession**, a **shared nexus**, or pure **random variability**. Yet, as the system evolves, **independent variables**—or even sets of **mutually independent variables**—can generate new **relations of dependence**, leading to intricate structures of **multi-dependence**.

Thus, phenomena that were initially **mutually independent** can progressively become **interdependent**, as causal relationships multiply and overlap. In these advanced stages of systemic evolution, the occurrence of a single event is rarely attributable to one unique cause; instead, it may derive from **multiple probable causes**, both **direct and indirect**, **proportional and inverse**.

This shift from simple independence to systemic co-dependence represents one of the foundational principles of *Impossible Probability*: the recognition that **probability is not static** but **dynamic**, producing new dependencies as variables interact across time and scale.

[This chaotic nature of reality is what leads us to sustain that *chance can create bias* — that structures and complex systems may, in fact, evolve from randomness.]

90.19. The Progressive Causal Chain in the Rainfall Example

In the first minute of rainfall, there may be **no direct relationship** between the increase in **traffic congestion** and the increase in **umbrella use**. These two effects, though simultaneous, remain **independent**. However, if the rainfall persists, the **probability of traffic accidents** may rise, indirectly motivating people to **avoid driving** and **walk instead**, thereby **increasing umbrella usage**.

Here, what begins as a set of **independent dependent variables**—each caused by the rain—gradually evolves into a **network of inverse relations**: as the **risk of traffic accidents** rises, **umbrella use** also increases, but the **use of cars** decreases. In this way, initially separate dependent variables begin to influence one another through **mediated probabilistic chains**.

The system evolves from **simultaneity** to **structural inversion**—a hallmark of stochastic causality, where indirect relationships acquire practical causal weight over time, even if they remain probabilistic rather than deterministic.

90.20. Multi-Causality and Hierarchies of Probable Causes

The increase in umbrella use on a rainy day can thus be explained by **a hierarchy of probable causes**.

1. **Direct cause:** Rain increases the need for protection against water exposure.
2. **Indirect cause:** The higher risk of traffic accidents discourages driving.
3. **Secondary social cause:** Increased preference for walking or public transport leads to greater umbrella usage.

Each layer introduces new variables that are **probabilistically connected** to the original cause but not **causally linear**. Over time, the network of dependencies expands into a

complex causal matrix, where any given outcome (e.g., umbrella use) results from **intersecting lines of probability** rather than from a single determinative factor.

In such systems, *Impossible Probability* recognizes **causality as distributed**, not singular. The probability of an event is the **sum of partial influences** across multiple independent variables acting through time.

[It is interesting that I am translating these paragraphs while Storm Amy is striking the north of England. I arrived in Manchester on the 3rd of October 2025, just as the storm began to hit the region. I remember how the city looked like a ghost town — there were no cars on the streets, and many people were walking with umbrellas.]

90.21. The Multi-Causal Origin of Primary Conditions

Even the **rainfall itself**—treated as an independent variable—may originate from an **infinite array of probabilistic interactions**:

- **Astronomical causes**, such as the tilt of Earth's axis influencing atmospheric pressure and temperature gradients.
- **Seasonal cycles**, linked to solar exposure and planetary position.
- **Chaotic micro-variations**, as symbolized by the famous "**butterfly effect**"—where minute atmospheric disturbances can alter global patterns.

Rain, therefore, is not an isolated cause but a **probabilistic emergent condition** resulting from the **interdependence of countless variables**. This concept encapsulates the **multi-causal architecture of stochastic systems**, where each phenomenon can itself be both the **effect of prior causes** and the **cause of subsequent probabilistic chains**.

90.22. Empirical Hypothesis and the Logic of Synthetic Sciences

In all **synthetic sciences**, scientific progress depends upon the construction of **empirical hypotheses** that attempt to relate phenomena—usually through **categorical**

relations such as cause and effect. These relations allow for **predictive control**: if A is the cause of B, then by manipulating A, we can anticipate or modify B.

However, when A and B are **sets of variables** rather than isolated magnitudes, multiple types of correlation arise:

- If **A is multiple** and **B is simple**, one measures the **correlation of each variable in A upon B**.
- If **A is simple** and **B is multiple**, one measures **A's effect on each variable of B**.
- If both A and B are **multiple**, one measures the **matrix of correlations** between all pairs of A and B.
- If both are **simple**, the model reduces to a single correlation—positive or negative—between A and B.

These models define the **geometry of probabilistic interaction**, representing the multi-dimensional logic through which *Impossible Probability* articulates the relationships among empirical variables.

90.23. Probabilistic Causality Versus Determinism

To speak of **cause and effect** within a probabilistic theory is to transcend the simplicity of **mechanical determinism**. In stochastic systems, causation exists not as an absolute necessity but as a **gradient of probability**. When we say "A probably produces B," we mean that the **occurrence of B** depends on A with a **certain probability**, yet not with certainty.

This principle distinguishes **indeterministic (stochastic) models** from **deterministic ones**.

- In **determinism**, if A occurs, B *must* follow with fixed magnitude.
- In **stochastic theory**, if A occurs, B *may* follow with variable magnitude—subject to statistical dispersion and margin of error.

Hence, in *Impossible Probability*, what we measure are **correlations**, not fixed causalities. These correlations can be:

1. **Random (aleatory) correlations**,
2. **Correlations between independent variables**, or
3. **Correlations derived from causal relations**—where A makes B probable, but not certain.

90.24. Measuring Correlation and the Logic of Empirical Probability

If we express this probabilistically, we can say:

- "A, therefore probably a magnitude of B." This means that **the rate of B** is measured **as a function of A**, so that **the greater the magnitude of A**, the stronger the **positive correlation**, and vice versa for negative correlation.

When empirical measurement reveals that two or more factors have **similar empirical probabilities**, it suggests—but does not confirm—a potential **correlation** among them. In the absence of a prior causal hypothesis, such similarities merely indicate **simultaneity or succession**. Only through a rational hypothesis can one test whether **A is a probable cause of B**, or whether both A and B share a **common antecedent**.

Even when a correlation appears causal, one must always admit a **margin of doubt**: the relationship could be **fortuitous**, **indirect**, or **chaotically emergent**. This epistemological humility defines the **critical rationalism** underlying *Impossible Probability*.

90.25. Hypothesis, Rational Deduction, and the Scientific Method

Establishing a **causal relationship**—that "if A, then positively or negatively B"—requires the formulation of a **scientific hypothesis**. For this reason, *Impossible Probability* situates itself within the **hypothetico-deductive framework** of critical rationalism.

Only when **direct or inverse causality** is empirically ruled out can one classify the relationship as **random**; otherwise, the hypothesis remains **provisionally rational**. Thus, the scientific method demands:

1. **The formulation of a clear hypothesis**, grounded in logic.
2. **Testing within defined margins of error**—only within these limits can a hypothesis be provisionally accepted as true.
3. **Recognition of provisional validity**, pending future refutation or revision.

A hypothesis must be constructed with **functional precision**, ensuring that the relationship between variables is **mathematically and conceptually coherent**. This is why *Impossible Probability* dedicates its final section—**Section 25 of *Introduction to Impossible Probability, Statistical Probability or Probability Statistics***—to the **process of forming empirical hypotheses**, integrating correlation, causality, and rational deduction into a unified model of scientific inquiry.

Rubén García Pedraza,19 de abril 2014

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